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New Advertisements.

In the growth of THE ELECTRICAL WORLD in circulation, size and general improvement, the value of its columns for reaching those engaged in electrical pursuits or interested in electrical matters has not failed to be appreciated by advertisers. Readers will find it to their advantage to keep their eyes on the advertising as well as the reading columns. The following are the new advertisements in this issue:

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Vol. X. NEW YORK, JULY 2, 1887. No. 1.

WITH the present issue we begin Volume X. of THE ELECTRICAL WORLD. Not only will the current volume more than maintain whatever there has been of merit and excellence in its predecessors, but it will present an unusual feature in containing 27 numbers. The contents of to-day exemplify very thoroughly the variety of work to which electricity is now being put, and fairly portray the great activity in every field of electrical research and practice.

IN spite of the losses which must occur in the distribution of power by means of compressed air, the system as employed at present in Paris seems to have met with some success, not a little of which is perhaps due to the ventilating and cooling properties of the exhaust from the air engines employed. If high tension current distribution were permitted in Paris, the present method could hardly hold its own, but under existing conditions it is found to be a convenient source of power for driving dynamos for electric lighting purposes.

LAST week we published some details regarding the action proposed to be taken by local lighting companies in supplying themselves with carbons. This week we print a series of special dispatches showing how the news has been received in various parts of the country. The present stage of affairs is evidently a highly interesting one.

THE signing of the Subway bill by Governor Hill promises to give a great impetus to electrical matters in this State. More than one important enterprise has been arrested by the late troubles, and the prospects are that with the subway question now settled they will all be vigorously pushed forward to completion. Electricians hereabouts will take the law as it stands, thankful for the fact that matters no longer remain in uncertainty.

THE effect of the electric light on plants was early shown to be beneficial in stimulating their growth, but there has been recently recorded a case in which the reverse effect has been noted. It seems that the winter palace of the czar at St. Petersburg is on festive occasions illuminated by electric light, and the palms and exotics used in decorating the banqueting and other rooms are believed to suffer from the blaze of light. The leaves, it is said, turn yellow, dry up, and then fall off. The action of the light is thought to be too intense and sudden on them after their transference from the conservatories where they are wintered. Considering that this is the first instance in which such a detrimental effect has been noted, it would be worth while to investigate the subject further to determine whether the effect is due to the electric light, or whether other influences may not be at work besides the illumination.

THE London *Electrician* in its issue of June 17 devotes an editorial of considerable length to the effort now being made by the American Institute of Electrical Engineers to secure a home of its own. It reviews the growth and good work of the Institute since its establishment in 1884, when, as it says, the Institute came into existence in time to be honorably represented at the meeting of the British Association in Montreal that year. With regard to the special object of the present movement, it says: "In commending this scheme to the favorable attention of our readers, we cannot abstain from noting the eminently sound and practical character of the American Institute of Electrical Engineers. Casting a glance over the list of papers brought under its notice between May, 1884, and the corresponding month of the present year, we are struck by the unvarying utility of the subjects dealt with; and this impression is confirmed by such of the discussions as have been reported in American journals coming to our hands." The article closes as follows: "We have not obtained and we hardly expect to receive from America any supremely valuable contributions to our stock of mathematical and scientific knowledge; but she has supplied us with much that is in the highest degree valuable in the domain of practical and applied science; and we are the more thankful for it, because its diffusion here may counteract our tendency to wander into fields of abstract speculation. The American Institute of Electrical Engineers has a very useful career before it, and the venture on which it is just now embarked deserves, and will receive, the best help we can give it." Our contemporary may rest assured that this frank and friendly encouragement will be appreciated to the full by the council and members of the Institute.

WHILE on this side of the water the ingenuity of inventors has been employed in the devising of telephone transmitters which shall not operate on the continuous circuit plan, or in other words, shall be of the make and break type, inventors in England have sought to remove existing difficulties by devising transmitters which shall not embody diaphragms or their equivalents, in their construction. This course of action has been brought about by the decision of the English courts in relation to the Edison patent claim for "the combination with a diaphragm or tympan of electric tension regulators, substantially as described." In the course of the inquiry one eminent witness defined a diaphragm to be "anything which separated anything from anything else;" and although the courts did not exactly endorse this wide-reaching interpretation of the word, yet, as *Engineering* remarks, they have practically construed its meaning, as used in Edison's claim, to be any device which receives the vibrations of the voice and transmits them to an electric tension regulator, such as a microphone. Therefore, a telephone transmitter, to be clear of Edison's patent, must be free from the presence of any sounding board, resonator, or other appliance conveying the air impulses to the contacts by which the intensity of the electric currents is modulated and controlled. Many inventors have imagined that they have produced instruments fulfilling this condition, but the application of the legal-scientific mind to the apparatus has demonstrated, in very numerous cases, that the designers have been self deceived, and that although much disguised, the diaphragm or tympan formed an essential feature of the instruments. The question, therefore, What is a diaphragm? is a very interesting one in English telephonic circles. The apparatus described in another column, in which it is claimed that no part answers the purpose of a diaphragm, is of interest because here every precaution has evidently been taken to prevent resonance in the parts supporting the carbon contacts. That such an apparatus will work seems evident, but it is a question whether the results obtained are as good as from devices in which the transmitter has resonating properties.

WE Americans are often accused by foreigners of exaggerating the progress made by us in comparatively short periods, and many of the statements made are looked upon with distrust abroad. It is, therefore, most refreshing to have placed before us the unbiased opinion of a foreigner who has come among us to study an industry which, though young, has received its greatest industrial development in America. It was but a short while ago that we had the pleasure of meeting Mr. Friederich Ross, an engineer, and member of a firm engaged in electric lighting in Vienna, who has now returned home, and who, in an address before the Elektrotechnische Verein, of Vienna, gives the impressions which a study of the electric light industry in this country made upon him. Mr. Ross stated at the outset that he came here biased to the extent that he believed the reports which reached abroad to be untrue. When he entered New York harbor and saw the Statue of Liberty on one side and the beautiful arch of lights on the Brooklyn Bridge on the other, his opinion was somewhat shaken. It required but a short sojourn here to convince him that what he had heard was not only true, but that the half had not been told. Mr. Ross passed in rapid review the different systems of lighting in use in this country and laid special stress upon the boldness with which we have attacked the problem of high tension distribution. Mr. Ross stated, evidently with the purpose of astonishing his hearers, that we thought nothing of running fifty arc lamps in series at 3,000 volts potential, and that at meetings of electricians which he had attended in this country 10,000 volts was spoken of with perfect assurance as practical. He spoke with great warmth as to the perfection and durability of American dynamos generating such high tension currents, and as to the perfect regulation obtained, notable instances of which he cited as coming under his own observation. We observe only one remark of disfavor, and that is with regard to the want of steadiness of our arc lights, which he thinks could be improved upon. Tower lighting seems to have struck our visitor quite favorably, and after his experience at Detroit he thinks that in cities with wide streets it presents a good solution of the city lighting question. Indeed, he even recommends it for some of the wider streets in Vienna. Incandescent lighting also received the careful attention of Mr. Ross, and he saw in our methods of exploitation much to commend. Power distribution by means of electricity impressed him also as one of the most promising fields of development, and his observations convinced him that it was the ideal method and could be undertaken anywhere with success in competition with any other method. With regard to our electric railways, which Mr. Ross only studied in a cursory manner, he says that all that he saw operated smoothly, but he was also not a little impressed with the extent of our cable railway systems. Perhaps some years hence he will, if he revisits us, have something more to say of our electric railways. In regard to American methods of running wires overhead, Mr. Ross states that they are characteristic of Americans. Our prime object, he remarks neatly, is to introduce a thing and to get to work as fast as possible, and to leave to time the refinements which give stability and permanence; but in Europe that order of things is just reversed. Notwithstanding the state of our wires overhead, Mr. Ross confesses that diligent inquiry failed to bring to light a single case during the past year in which a person not connected with the lighting station was injured by coming in contact with the wires. In the accidents reported, the victims were those connected with electric light stations who neglected the usual precautions. Among the other facts with which Mr. Ross occupied the attention of his hearers, and which are usually scoffed at, was the marvelous development of our fire-alarm systems. His experience in Chicago, where, upon one occasion, the alarm turned in sent the firemen out of the house before he had time to get half way down stairs from the floor above, created quite some amusement among the audience. The keyless alarm boxes, which can be opened by any one by the mere turn of a handle, evidently appeared to him as evidencing a high degree of republican communal development such as can only be met with in America. This, and much more, shows that Mr. Ross has made good use of his opportunities, and has judged us fairly. The good impressions gathered here are not the only things which our visitor has taken away with him. Judging from the hints which he threw out, his hearers will soon be able to judge, by actual inspection, of the merits of American electrical apparatus, which will find its way abroad as a direct result of his trip.

NEW BOOKS.

L'ECLAIRAGE DANS LA VILLE ET DANS LA MAISON. By Ph. Delahaye. Paris: G. Masson. 1887. Paper, 296 pp. Price, $4.00.

The author's object has been to place before the reader the present status of lighting, both public and domestic, and to explain in simple terms the methods of manufacture and the applications of the various kinds of illuminants in use at the present time. As is but natural, an historical sketch is given, in which the lights employed by the ancients are described down to the oldest means in use to-day—the candle. We find here a very concise analysis of fats employed in the manufacture of the latter, and an interesting account of the machinery employed in their manufacture.

Lighting by oil, mineral, vegetable and animal, is similarly treated, and we are given some valuable information regarding the mode of obtaining the same and its preparation.

Gas and its manufacture take up a considerable portion of the volume, and the numerous processes employed are discussed with notable minuteness. The advent of electric lighting has given such an impetus to gas manufacture and stimulated gas engineers to such a degree that it might almost be said that gas lighting has been improved more in the last ten years than in the fifty years preceding. Hence we find quite a number of new methods of gas manufacture as well as of means for its application, in the form of burners.

The author, who has devoted much of his time to electric lighting, has succeeded in placing next before the reader a most concise account of it in regard to its manufacture and application.

The last chapter of the book treats of the various applications of lighting for special purposes—lighthouses, harbors, ships, mines, railway cars, etc.

Throughout the work the author has looked at the question from a practical standpoint and in the modes of light the cost as well as its applicability has been considered. The volume is handsomely illustrated, and is printed in clear and bold type.

THE STORAGE OF ELECTRICAL ENERGY AND RESEARCHES IN THE EFFECTS CREATED BY CURRENTS COMBINING QUANTITY WITH HIGH TENSION. By Gaston Planté. Translated from the French by Paul Bedford Elwell. New York. 1887. D. Van Nostrand. Cloth, 268 pp. Price, $4.00.

At the present time, when the storage of electrical energy occupies such a large share of the attention, not only of electricians but the public generally, the researches of one who accomplished the first practical work in this direction cannot but be of interest, and when we add to this the fact that the experimenter before us may be considered an ideal one, in that he prosecutes his work merely for the sake of science, without looking to the ulterior gain which may be derived therefrom, the record of his investigations possesses a double value. Indeed, in looking over Planté's collected works, which are embodied in this volume, we are strongly reminded of Faraday's works from the simplicity of form in which the matter is presented to us, and the modest way in which a great thinker leaves us to judge of the correctness of the results obtained by him, without asserting his own individuality in the matter.

This volume, as stated in the title, gives the results of labors which extended over a period of twenty years, beginning with 1859; and it is divided into six parts, of which the first is devoted to the study of secondary voltaic currents and the storage battery *per se*. In the first chapter, the author gives a short sketch of the facts which lead up to the subject, beginning with the polarization currents discovered by Gautherot in 1801, and passing in review the work of Ritter, Volta, Marianini, Becquerel, De la Rive and others. We are then introduced to the experiments with different metals as electrodes in a polarization cell, all the phenomena attending the use of copper, tin, lead, aluminum, gold, iron, zinc and platinum being described, together with the effect of varying the electrolyte. And finally we have the conclusions derived from this work which caused Planté to select the lead plate as the most efficient.

We are given in the second and third chapters a fine analysis of what a lead plate secondary battery ought to be and of the methods employed by Planté in accomplishing his desired ends, the points touched on including the necessity of a large surface, so as to introduce the least resistance, the method of forming the cells, the chemical actions involved, their maintenance, and a large number of details, too numerous to mention.

As the original designs of Planté cells with "formed" plates have by no means been discarded, but on the contrary are finding considerable favor, especially abroad, this part of the work is a most valuable guide to those who may wish to apply the results here recorded.

The experiments which Planté made with his storage cells, by means of which high tension currents of prolonged duration can be obtained, form the subject matter of the remaining part of the book, and present a most valuable record of work extending over a wide field.

The translator has accomplished his task in an admirable manner, and he deserves the thanks of the English speaking electrical community for having placed at their easy disposal such a valuable record as this is.

American Institute of Electrical Engineers.

A monthly meeting, with dinner, was held by the American Institute of Electrical Engineers at Martinelli's Restaurant, on June 28, at 6 P. M. The attendance was good. Before proceeding to the regular business of the evening, Mr. G. M. Phelps, Jr., chairman of the Committee on Permanent Quarters, reported that since the annual meeting in May, no less a sum than $4,500 had been contributed by members toward the house fund, and that in addition a single subscription of $1,000 had been promised. The committee thought that such a result was very encouraging, and that it augured most favorably for the speedy realization of the desires of the Institute. Mr. Phelps further reported that the American Society of Civil Engineers, now in need of more accommodation than its own house affords, was wishful to have the co-operation of the Institute in its plans for enlargement, etc., and that the Institute of Mechanical Engineers also appeared willing to be an associate in so good a work; thus reverting to plans which the Electrical Engineers, as shown in their Transactions, had had in view and under discussion since 1885. A joint committee of the Civil and Electrical Engineers had met and now had the matter in hand. It had already inspected various pieces of property, and it was believed that the committee would be at an early day in a position to make a definite and satisfactory report of action taken in common. As evidence of the interest generally felt in the work of the Institute, Mr. Phelps stated that since May over 40 new members had joined the Institute and that over 25 gentlemen were now awaiting admission.

Mr. G. W. Blodgett, electrician of the Boston & Albany Railroad, then read an admirable paper on "Electric Train Lighting," which was followed by an earnest and lively discussion of the points raised.

Dr. Aron's Integrating Ampere-Meter.

Dr. Aron, of Berlin, some time ago devised an ampère-meter, based upon the principle adopted by Profs. Ayrton and Perry in their original watt-meter, in which the retardation of a clock pendulum indicated the expenditure of power. In Dr. Aron's instrument for measuring current (or volts) the bulb of the pendulum is replaced by a permanent magnet, and below this is placed a coil traversed by the main current. The pendulum is therefore subject to acceleration when the current passes. By comparing the time of this clock with standard time, and multiplying by a constant, the ampères or volts are integrated. The instrument has the obvious defect of depending upon the constancy of a permanent magnet, and when that magnet, as in the present case, swings to and fro in a variable field, it seems doubtful whether the calibration will long hold good. However, Dr. Aron, without altering this feature has recently effected certain improvements in the construction, which are thus described in *Industries*: "There are two pendulums, one with a magnet, the other with a common bulb. Each actuates its own escapement, and by a train of planet wheels the differential motion is registered on a dial similar to that of a speed counter or gas meter. Dr. Aron has also added a magnetic catch, which arrests both pendulums when no current is flowing, and releases them when one-tenth of an ampère or more is passing. By this addition the interval for rewinding the clock has been increased to about four weeks for average work."

The American Institute Electrical Exhibition.

The Exhibition Committee of the New York Electrical Society having in charge the exhibition to be given next fall at the American Institute met on the afternoon of June 27. There was a large attendance. President John M. Pendleton called the meeting to order, and after he had stated the progress which had already been made toward securing a very fine and interesting exhibit, the details of the management were discussed. This resulted in the appointment of a number of committees, the names and members of which are given below:

COMMITTEE ON FINANCE.—Francis Forbes, Frank W. Jones, George G. Ward.

COMMITTEE ON SPACE.—A. C. Fowler, W. C. Temple, R. W. Pope, C. G. Curtis, G. M. Phelps, Jr.

COMMITTEE ON TRANSPORTATION.—George Worthington, Ch. L. Levey, W. A. Vail.

COMMITTEE ON ELECTRICAL INSTALLATION.—C. O. Mailloux, J. A. Seely, C. S. Bradley, A. A. Knudson, H. L. Waite, George A. Hamilton, J. A. Barrett, C. L. Clarke, C. L. Edgar.

COMMITTEE ON ENTERTAINMENT.—A. A. Knudson, Dr. Vander Weyde, H. A. Sinclair, T. A. Edison, Dr. Otto A. Moses, E. C. Davidson, Prof. A. M. Mayer, Jas. A. Hamblet.

COMMITTEE ON EXHIBITS.—Dr. M. J. Roberts, Dr. Otto A. Moses, Geo. A. Hamilton, M. M. Davis, T. Wolcott, Alf. Shedlock, A. A. Knudson, C. O. Mailloux, S. S. Wheeler, W. B. Van Size, J. F. Kelly, F. B. Herzog, Wm. Hochhausen, Leo Daft.

COMMITTEE ON CORRESPONDENCE AND PUBLICATION.—Alf. Shedlock, C. E. Stump, Dr. Vander Weyde, G. M. Phelps, Jr.

COMMITTEE ON HISTORICAL APPARATUS.—Dr. P. H. Vander Weyde, J. A. Hamblet, A. G. Holcombe.

Sizes of Wire for Incandescent Lighting.

To the Editor of The Electrical World:

SIR: Will you kindly inform me of the simplest method of determining the size of wires for incandescent lighting? X.

ANSWER.—The size of the leads should be calculated from the loss of potential which is allowed in the leads. In small, well designed plants this loss is from 2 to 3 per cent., while in larger plants it is from 5 to 8 per cent.; but such a great loss should not be allowed unless there is some means of regulating the potential at the lamps (in which case as high as 30 per cent may be allowed), or unless the total number of lamps does not vary very much. The simplest formula is:

$$A = \frac{16.44\ C\ D}{V}$$

in which C is the current in the lead; D the distance from the dynamo to lamps in feet, or the half length of the lead, V the number of volts lost in the leads; 16.44 is a constant depending only on the resistance of copper and on the units used, and A is the cross sectional area of the wire in square mils, from which cross section the diameter may readily be determined by calculation or from tables of areas and diameters. If C is the current per lamp, and n the number of lamps, the formula is simplified to

$$A = n\ D \left(\frac{16.44\ C}{V}\right),$$

in which the quantity in parenthesis is calculated once for all. By properly choosing V it can be made a very simple number.—EDS. E. W.

Potential of Induction Coils.

To the Editor of The Electrical World:

SIR: How much greater is the potential of the secondary current from an induction coil than that of the primary? Of course the windings of the induction coil and amount of battery used must enter into the calculation; but take the induction coil of a Blake transmitter and one cell of Leclanché battery as a basis, how much greater is the energy of the induced current than in the primary? INQUIRER.

ANSWER.—The potential, on open circuit, of the secondary coil, depends on the current in the primary and on the number of turns of the primary and the secondary, and on the disposition of the coils and the iron. The available potential on closed circuit depends on the same factors, and also on the resistance of the secondary and of the external circuit. Your question, therefore, cannot be answered without knowing the constants of the coil. It is not possible to state theoretically what this coil would give, any more that it would be possible to do so for a dynamo, without a practical measurement, or unless very complete data are given. You are mistaken in thinking that the energy of the induced current is *greater* than that of the primary; it is always *less* by the amount lost in the coil itself. An induction coil only changes the qualities of the energy, but does not generate or produce energy.—EDS. E. W.

Determining the Resistance of Fire Alarms Circuits.

To the Editor of The Electrical World:

SIR: Can you refer me to any book which gives clear practical rules for determining the following points: 1. How many cells of gravity battery should be used to operate a fire-alarm system, knowing the length and resistance of the line wire and the number of gongs to be struck? 2. The proper resistance of the coils of the electro-magnets operating the gongs. 3. The number and arrangement of cells of Leclanché battery required to operate most economically a series of bells in multiple circuit, and also the proper resistance of each bell. 4. The proper sizes of main and branch wires for an incandescent light plant, knowing the voltage of the current at the dynamo, the length of the main wire, the number, resistance and location of the lamps.

For any clear and definite practical information on any or all of these points I shall be grateful. INQUIRER.

PITTSFIELD, Mass.

ANSWER.—1. The general rule is that the maximum effect is produced in the external circuit when the resistance of the external and internal circuits are equal. The external resistance in your case is that of the bells alone, and the internal resistance that of the batteries and the line wire. You must assure yourself, however, that the current obtained under these conditions will be sufficient to operate the bells. A more reliable method is to find by experiment how many cells are required for one bell connected directly to the battery, and then measure the total resistance of that bell with its batteries; the number of cells required for your system will then be in the same proportion to the number required for one bell, as the total resistance of the whole system (including line and cells) is to the resistance of one bell and its cells. The number of cells in the two cases will also be in the same proportion as the resistances of the external circuits in the two cases, in which, however, the external circuits must include all outside of the battery. 2. The same rule applies, namely, that the resistance of the bells should be equal to that of the cells and leads together, provided the current is then strong enough to operate the bell; this of course depends on the mechanism of the bell. In general, for high resistance or long circuits, the bells should be wound with fine wire, and for low resistance or short circuits they may have thicker wire, but as the latter would only cheapen the magnets of the bells it is of little importance. In general the law holds good that the finer the wire the greater the economy of battery power, provided the ampère-turns of the magnets of the bells is the same. 3. See answers 1 and 2. It should be known how many bells will ring at the same instant, and their joint resistance must be taken in multiple arc, and not in series as before. If the bells are used frequently the recuperating power of the cells must also be considered; this will affect only the number of cells in multiple arc. 4. See a similar question and answer to another correspondent in this issue.—EDS. E. W.

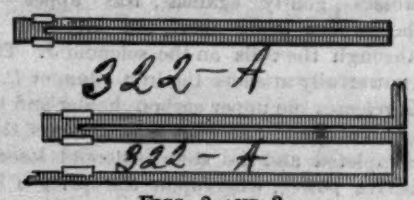
The Faraday Disc Dynamo of Jehl and Rupp.

In all disc machines constructed, thus far, the armature is built up of copper bands, either in a zig-zag form around the centre of the armature or consisting of coils placed together around the centre. In both these cases there exists always a considerable space where there is no copper; or if in the latter case the single coils are made of many turns, each becoming gradually smaller, it is evident that the electromotive force due to some of these additional turns is almost insignificant in comparison to the increase of resistance due to these additional coils or turns. According to the London *Electrician*, Messrs. Jehl and Rupp have succeeded in constructing an armature where all space inside the outer circumference is occupied by copper, and in which each and every coil or turn has the same area. In this dynamo only two magnets of considerable mass in iron are employed. As shown in Fig. 1, which represents one of the pair, the poles of like name are diagonally opposite each other. Two such magnets are placed opposite each other, so that every north pole of one faces a south pole in the other, and *vice versa*, and in the field so formed, the armature revolves.

In the construction of the armature, the inventors take a strip of copper, as shown in Fig. 2, which has a slit 1.5 mm. in thickness, and extending to about 40 mm. from one end. At this end, and on both sides of this strip, are incisions which serve the purpose of holding these pieces of copper to the shaft, by means of two plates, which have at their outer circumference flanges which fit into the incisions. It is evident that, instead of incisions, projections may be employed, as shown by the dotted lines in Figs. 2 and 3. They then take this strip, put it in a form, and press it into a shape somewhat as shown in Fig. 4. Fig. 4 shows, however, only one-half of one turn and three-fourths of another, showing also how one turn is connected to the other. It is evident, therefore, that each coil fits into the other, and the connections are made at the outer circumference by means of small caps, as shown in Fig. 4. It will be seen from this construction that every coil has the same area, and each coil is so divided that one-half is in the inside of its neighboring turn, while its other half is on the outside of this neighboring turn; also that one-half of every turn is on one side of the armature, while its other half is on the other side. Thus one turn can be placed inside the other until the armature is complete. Of course it is understood each turn is insulated from the others. It must be understood that this construction is not a simple mutual overlapping of coils, which would cause an oblique or sloping position of the coils, but is a mode by which each half of the coil lies in a different yet parallel plane, and between these two planes is placed some insulating material.

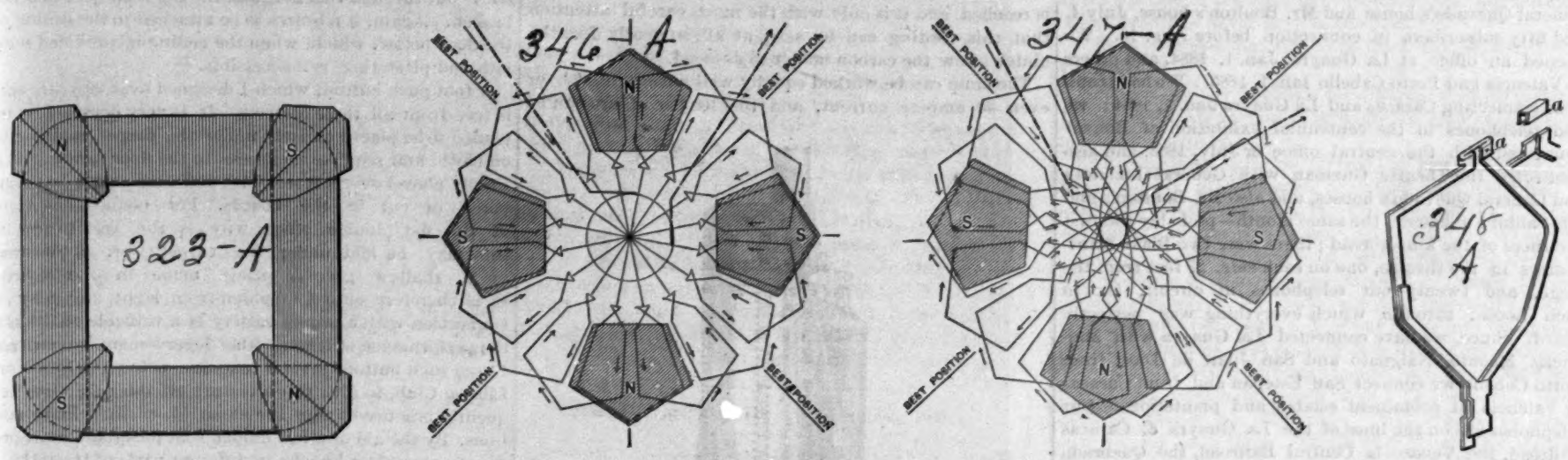
In Fig. 5 is shown about one-fourth of the armature; *a* is the part of a coil to which the commutator bar is connected; *b* is the part where the flanges of the plates that are attached to the shaft rests (the plates and shaft not being shown); *c* is a ring of wood with teeth, which teeth pass into the space between each connecting cup while on the top of this ring wire is wound to hold or bind all together.

To gather the currents induced in the coils, there are



FIGS. 2 AND 3.

different ways depending on the number of coils in the armature. If, for example, it is a number which can be divided by four, they can be connected as shown in Fig. 6. Here the commutator blocks, which are diametrically opposite each other, are connected together by putting every pair of opposite coils in multiple arc, thus giving for the whole machine double the current and half the electromotive force. If there is an odd number of coils the connections are made as shown by Fig. 7. This puts all coils in series, and thus double the electromotive force and half the current is obtained.



FIGS. 1, 6, 7 AND 4.—JEHL & RUPP DYNAMO.

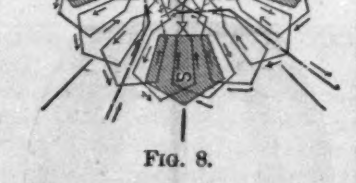
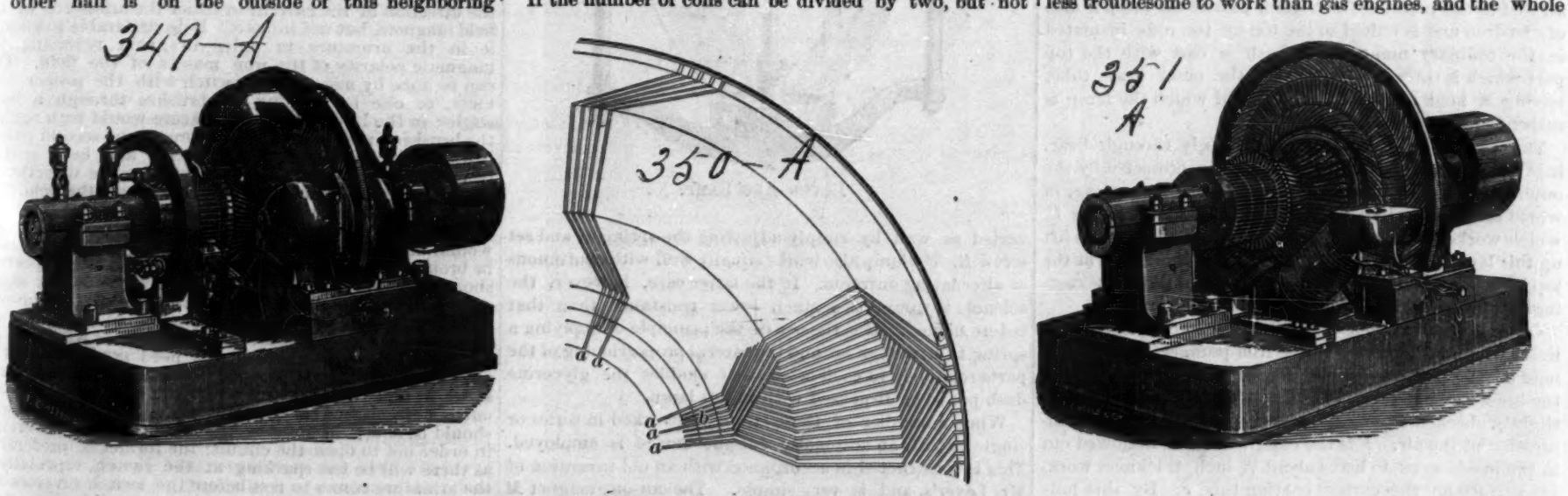


FIG. 8.

If the number of coils can be divided by two, but not by four, the connections are made as shown in Fig. 8. This is a novel method. The coils are also all in series, and yet all the commutator bars diametrically opposite each other are connected together, and on one side the bars appear to be without connection with the coils. However, when the brush touches that block it collects the current of the coil which is attached to the opposite block. Of course, in all cases described the number of commutator blocks must be equal to that of the coils in the armature.

Fig. 9 shows the disc machine complete, and which size is capable of giving 350 ampères and 110 volts, using about 5 per cent. for the field magnets, and running at 735 revolutions per minute. The copper in the armature weighs about 24 kilogrammes. The machine is 80 centimetres high and 130 centimetres long. Fig. 10 shows the same machine, with a fourth of its magnetic system taken off so as to get a better view of the armature.



FIGS. 9, 5 AND 10.—JEHL & RUPP DYNAMO.

Magnetized Iron in the Voltaic Cell.

At a recent meeting of the Berlin Physical Society Dr. Gross explained his theoretical views on the heat of solution of magnetized iron, leading to the conclusion that the heat of solution of magnetized iron must be greater than that of unmagnetized. One result of these views was that a piece of magnetized and unmagnetized iron in a conducting fluid capable of dissolving the iron must give a current; this he has already demonstrated two years ago. The current in such an element as this flows across the fluid from the magnetized to the unmagnetized pole, and is independent of the nature of the magnetization. The source of the electric current is in this case, according to the views of the speaker, to be sought for in the loss of specific magnetization which the molecules of iron undergo as they pass from the solid to the fluid condition. Of the various solutions of salts of iron which were used in these experiments, only neutral salts of ferric oxide were found to yield a result, while the salts of ferrous oxide gave no current. The cause of this is, according to the speaker, that only the ferric salts lead to a solution of the magnets. Dr. Nichols has quite recently carried on some experiments on the heat of solution of magnetized iron, and has obtained the same experimental results, namely, that the heat of solution of magnetized iron is greater than that of unmagnetized, although he starts with theoretical views respecting the magnetic potential of solid iron and iron in solution which are diametrically opposed to those of Dr. Gross.

Electric Lighting by Compressed Air Power.

The system of distributing power, principally for electric lighting, by compressed air, which was commenced some twelve months ago in Paris by M. Victor Popp, has met with a very fair degree of success, says the London *Electrician*, notwithstanding its want of economy. This has arisen in part from the fact that the motors are far less troublesome to work than gas engines, and the whole of the attendance required can readily be provided by unskilled labor. Moreover, in certain cases, for restaurant keepers more especially, the refrigeration produced by the expansion of the air is regarded as a feature of very considerable value. The total efficiency of the compressed air plant is believed, however, not to be much higher than 10 or 12 per cent. At Paris the works are established at Saint Fargeau, and the conduits are carried to a total distance of 10 kilometres. It is estimated that, after allowing for the loss of power due to the heating of the air during compression, at least 50 per cent. of the available pressure is lost by leakage by the time the extremity of the line is reached. After this we have to allow for the efficiency of the air engine, and

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of the dynamo. However, as the cost of producing one horse-power at Saint Fargeau does not exceed 6 to 7 centimes per hour, and as M. Popp receives as much as 70 centimes per horse-power hour in the Chausée d'Antrim, a margin of profit would be left, even with a 10 per cent. efficiency. We understand that the offices of the journal *Le Figaro* will shortly be lit with 400 lamps by this system.

The Telephone in Venezuela.

Mr. James H. Howard, manager of the Intercontinental Telephone Company, gives further information regarding Venezuela concessions and what has already been done by the company, which has secured the original exclusive one, which was granted June 11, 1883, and confirmed by the Venezuela Congress. Mr. Howard says:

"Under this concession we opened our central office in Caracas Aug. 1, 1883. We had lines in central office and telephones in General Guzman's house, July 3, 1883; in General Quevado's house and Mr. Boulton's house, July 4, and fifty subscribers in connection before Aug. 10. We opened an office at La Guayra, Jan. 1, 1884, and others at Valencia and Porto Cabello Jan. 1, 1885. We had trunk lines connecting Caracas and La Guayra Jan. 1, 1884; we had telephones in the centennial exhibition of Bolivar connected with the central office in July, 1883, and also connected the Theatre Guzman with General Guzman's and General Quevado's houses, and also Mr. Boulton's and Mr. Santana's houses the same month—probably the first instances of the kind abroad; there were two Blake transmitters in the theatre, one on each side, 25 feet from the stage, and twenty-four telephones in circuit, six in each house, through which everything was perfectly heard. Since, we have connected La Guayra with Maiquetia, Macuto, Naiguato and San Juan de Dios; from Porto Cabello we connect San Esteban and from Caracas to Valencia all prominent estates and plantations. Our telephones are on the lines of the La Guayra & Caracas Railroad, the Venezuela Central Railroad, the Quebrada Land and Railway Company, and in its copper mines on the Porto Cabello & Valencia Railroad, the Rio Chico to Caranero Railroad, and all the terms of our contract have been observed, our subscribers satisfied, our shareholders in Venezuela have had their dividends quarterly, the government its 5 per cent. regularly. No complaints have been received as to service, and it would seem to be rather late to undertake to float a $5,000,000 company to operate abandoned 'Emmner' telephones in that country under a concession subordinate to ours, if not entirely worthless."

It is now stated that the company recently incorporated in Washington to seize the business in Venezuela under circumstances already mentioned in these columns is disbanding and that the stock subscriptions are being returned.

Lever's New Arc Lamp.

About two years ago we illustrated and described the well-known form of arc lamp invented by Mr. Charles Lever, of Bowdon, Cheshire, England. Since that time Mr. Lever has carried out many improvements in his lamps, and the type of lamp which we now illustrate embodies all the latest improvements. As will be seen from the engraving, the top part of the lamp, which is of iron, is all cast in one piece. The bottom part of the lamp is also of cast-iron and is united to the top by tie rods insulated in the ordinary manner. A bush is cast with the top part which is threaded to receive the outer brass tube, having a hook at the top by means of which the lamp is suspended,

The carbon holding tube *c* slides freely through bearings bored in the iron casting, and is protected by the outer tube. A small hole is drilled through the casting, in which is fixed the pin *p*, upon which is pivoted the lever *L*, which works freely on the pin. The spring *S* serves to lift up this lever when in its normal position, being held at the top by a pin which projects sideways from the iron casting, and at its lower end by the adjustable nut *N*.

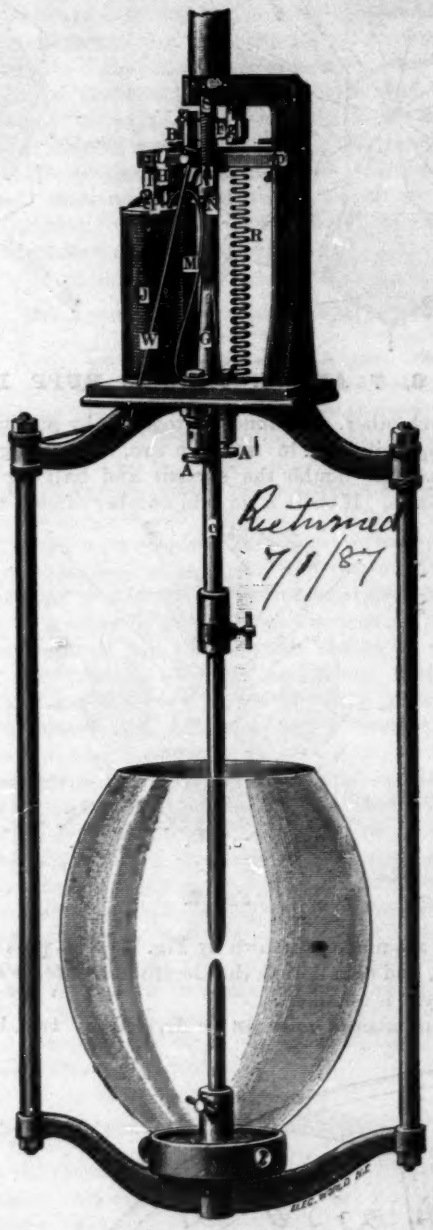
On the inside of one of the arms of lever *L* is a brass link *l* which is connected to the iron plunger *P* of the solenoid *J*. The iron core or plunger *P* fits nicely but easily in the brass spool of the solenoid, and when it descends it is slightly checked from any sudden movement by the compression of the air. *F* is the clutch which is hollowed out in the inside so as to leave about $\frac{3}{16}$ inch thickness working surface on the carbon holding tube *c*. By this hollowing out of the clutch, a better grip is obtained on the carbon-holder.

The clutch *F* is held by its arms in two brass sleeves *gg*, one fixed to a cross piece of the lever *L* and the other to the iron casting, so that when the lever moves, the arms of the clutch move freely in the sleeves. A set screw *B*, passing through the lever *L*, provided with a lock nut, enables the movement of lever *L* to be controlled and the length of arc to be adjusted. A brass wire *W*, with nuts at each end passing loosely through a brass pin on lever *L* and also through a hole in the iron casting, enables the lever to be drawn down and the top carbon holder to be released when the case is on the lamp, as, for example, in trimming the lamp.

In its normal position, that is, when no current is passing through the lamp, the spring draws up the lever, tilts the clutch, lifts up the upper carbon holder and separates the carbons. The solenoid *J* is wound with fine insulated wire to a resistance of about 300 ohms, and is connected as a branch to the binding screws *A A'*, thus placing it in a shunt circuit to the carbons. A small copper strip or brush *G* is fixed to the positive binding screw *A* and presses gently against the upper carbon holder. The carbons being apart, the only path for the current is through the coils on the solenoid *J*. The solenoid then powerfully attracts the iron plunger *P*, lowers the lever *L*, releases the upper carbon holder and the carbons come into contact. As soon as this occurs, the main circuit is completed and the shunt solenoid loses nearly all its attractive power, whereupon the spring *S* lifts the lever and the arc is formed. This action takes place instantaneously.

As the carbons burn away the resistance of the arc increases, the shunt solenoid gradually overcomes the attraction of the spring and lowers the lever. When the lever is horizontal, as shown in the illustration, the feeding point is reached, and it is only with the most careful attention that this feeding can be seen at all, so gently does the clutch allow the carbon holder to descend.

The lamp can be worked equally well with a 10, 20, or even 30 ampère current, and the length of arc can be



LEVER ARC LAMP.

varied as well by simply adjusting the spring *S*, and set screw *B*. The lamp also works equally well with continuous or alternating currents. In the latter case, however, the solenoid is wound to a much lower resistance than that before named. It is the use of the principle of applying a spring to strike the arc and the careful proportioning of the parts relatively to each other that enables the glycerine dash-pot to be dispensed with in this lamp.

When a number of these lamps are worked in series or single circuit, an automatic cut-out device is employed. This is constructed in accordance with an old invention of Mr. Lever's, and is very simple. The cut-out magnet *M* consists simply of an iron bar wound with two layers of coarse insulated wire. The iron bar of the magnet *M* is insulated from the frame, and one end of the coarse wire is connected with this iron core, the other end being connected by the coupling to the resistance strip *R*, equal to that of the carbons, and then to the negative binding screw *A'*. The broad-headed screw *H*, with its lock-nut, is so adjusted that when the lever is horizontal, and at the feeding point, it does not touch the iron core of the magnet *M*, but is at a little distance therefrom. Should the carbon holding tube get stuck, or the carbon break, or any accident happen to the lamp which prevents its feeding, the solenoid will draw down the lever until the screw *H* comes into contact with the core of magnet *M*. All the top part of the lamp frame being positive, it will then be seen that the current will pass through the screw *H*, core of magnet *M*, then through the magnet coils and resistance *R* to the negative terminal *A*. The lamp will then be cut out, and magnet *M* will continue to hold down lever *L*. Should, however, the carbons come into contact again, the spring *S* overpowers the magnet *M*, the current through its coils having been halved, and the spring *S* draws up the lever *L* and the arc is reformed, so that the lamp is automatic in every way.

In working on incandescent circuits the cut-out device, of course, is not necessary, as the solenoid is wound to a high resistance, so that in the event of failure to feed the solenoid could not be damaged by a comparatively low E. M. F.

An Improved Floor Push Button.

To the Editor of The Electrical World:

SIR:—The floor push button illustrated on page 212 of your issue of May 7 has serious defects. It requires the making of a hole through the carpet and floor, it sticks out through that hole and the top is subject to being broken. Again, it requires to be attached to the ceiling of the floor below, which, when the ceiling is provided with lath and plastering, is inaccessible.

A foot push button, which I designed over 20 years ago, is free from all these defects. It is very compact, is intended to be placed entirely under the carpet, matting or oil cloth, and requires no access to the floor below. It is simply placed over a recess ¾ in. diameter and ¾ in. deep, bored or cut in the boards. For connections some of the flat double office wire is the best to use, as this may be laid under the carpet; or, if desired, in a shallow groove, easily made in the boards. It is therefore entirely hidden from sight, and may in connection with a proper battery be a valuable addition in the performance of tricks, either legerdemain or spiritual. I used such buttons several years ago, before the New York Liberal Club, to illustrate a lecture on the deceptions frequently practiced under the name of spiritual manifestations. By the aid of a few hidden foot push-buttons, I produced mysterious knocks in different parts of the room.

P. H. VANDER WEYDE.

BROOKLN, L. I.

[Dr. Vander Weyde has sent us one of the push buttons referred to in the above note. It resembles very much the modern window burglar alarm spring, and might well be placed under a carpet without attracting attention.—EDS. E. W.]

Reversing Electric Motors.

To the Editor of The Electrical World:

SIR: In THE ELECTRICAL WORLD of June 5, 1886, page 258, under the head of "A Compact Electro-Motor," you say that this motor can be stopped, started or reversed by the simple movement of *a switch*. Can you give me any more definite information in regard to the manner of making these movements? Will all motors, or any, reverse by changing the polarity of the current?

BANGOR, Me. E. T. N.

[ANSWER.—We do not recall the exact arrangement of that particular switch, but the following general rules will probably answer your purpose: Neither a series wound nor a shunt wound motor will reverse the direction of rotation by a reversal of the direction of the current, which is evident from the fact that the polarity of both armature and field magnets is reversed. To reverse the direction of rotation of such motors it is therefore necessary to change the direction of the current in either the armature or the field magnets, but not in both. It is preferable to change it in the armature in order to avoid reversing the magnetic polarity of the iron masses of the field. This can be done by means of a switch with the proper contacts, or else by shifting the brushes through a large angle; in the latter case the armature would turn against the brushes; it is preferable therefore to use a second pair of brushes which are in such a position and have such a polarity as to be equivalent to changing the direction of the current in the armature independently of the field. For best working, the lead of the brushes should of course be on the other side of neutral line. For a single series wound motor in an independent circuit, the current should be broken before it is reversed in the armature, to prevent short circuiting the generator or battery. For a shunt wound motor in a similar circuit, the current should even be broken before the speed falls too low, to prevent short circuiting of the generator. In this case as well as with all shunt motors, the field circuit need not be opened at all, except when it is stopped for a long while. For a series wound motor in an arc light circuit or constant current circuit, either the armature or the whole machine should be short circuited by the switch before reversing in order not to open the circuit; the former is preferable, as there will be less sparking at the switch, especially if the armature comes to rest before the switch reverses the current. A series wound motor in an incandescent light circuit or constant potential circuit, should have its circuit opened before reversing; unless it has considerable internal resistance, it should not be started or stopped while the current is on, except with an adjustable resistance in series with it. A shunt-wound motor in a series circuit, or constant current circuit, should never have its armature circuit opened; it must be short-circuited before reversing. Lastly, a shunt-wound motor in an incandescent light circuit, or constant potential circuit, should have its armature circuit opened before reversing. It is very necessary to comply with these conditions. Any form of motor in a constant current circuit should be short circuited to stop it, while in a constant potential circuit the current must be broken to stop it. A series wound dynamo will reverse its direction of rotation when used as a motor, no matter what the direction of the current is. A shunt wound motor will always revolve in the same direction, whether it is used as a dynamo or as a motor; it is independent of the direction of the current.—EDS. E. W.]

Thomson-Houston Central Station in Brooklyn.

The station of the Citizens' Electric Lighting Company, of Brooklyn, N. Y., is probably one of the largest in the country, as from it as a centre 1,000 arc lights are distributed. The station building, situated at the corner of DeKalb avenue and Navy street, is a substantial structure of brick two stories high, with a basement, and 100 × 75 feet in

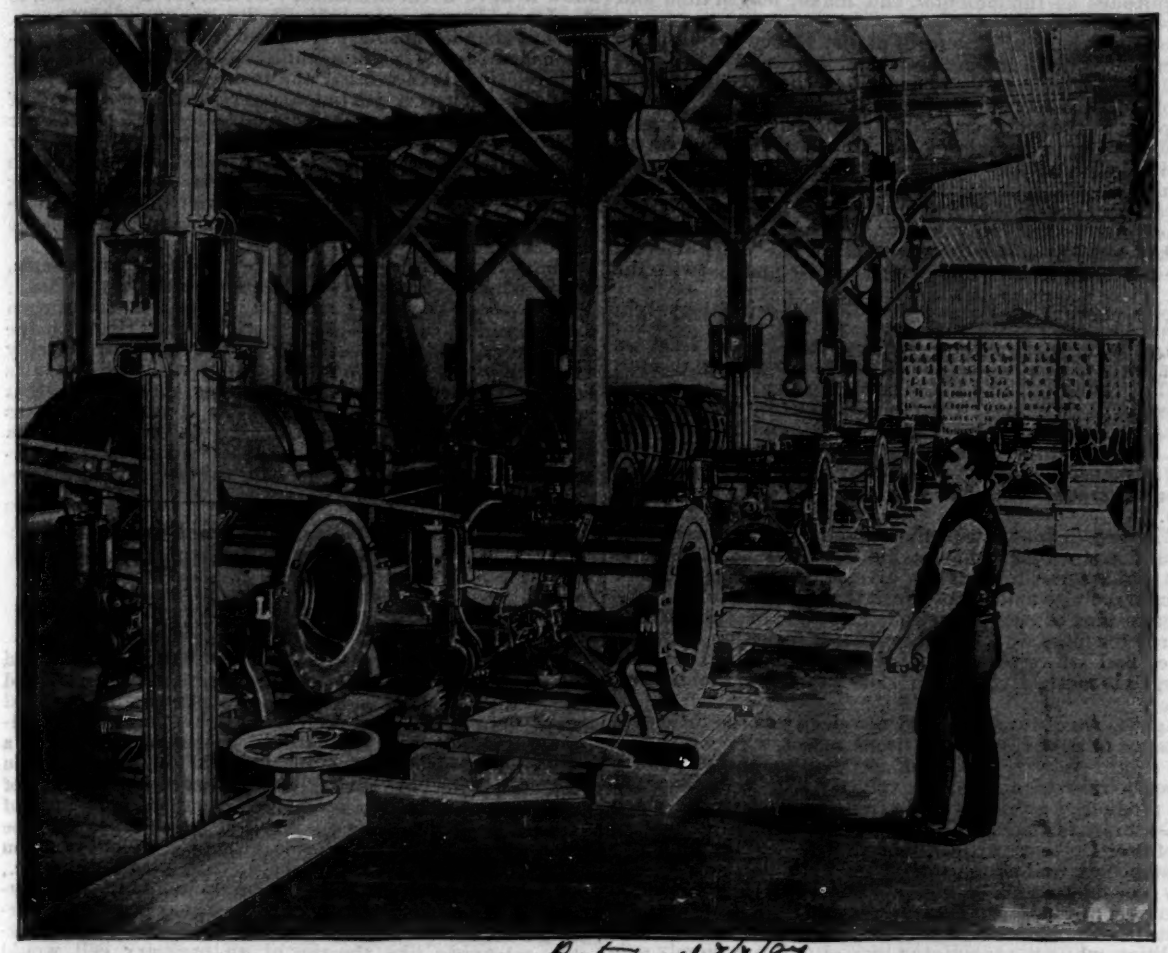


FIG. 1.—DYNAMO ROOM, CITIZENS' STATION, BROOKLYN.

extent. In the basement are the Logan boilers, of which there are six, each of a little over 100 horse-power, with steam pumps for boiler feeding purposes, and all the necessary conveniences for coaling, etc. On the first floor, a half story above the boiler-room, is the engine-room, in which there are two automatic cut-off engines, each of 300 horse-power. They are belted each to a single shaft running the entire length of the floor above, and on which are the pulleys operating the dynamos. The latter, of which there are twenty-nine, as shown in our illustrations, are arranged in two rows, and are driven from the centre shaft. In Fig. 1 will be seen the switch-board at the end of the room, by the aid of which connection is made with the various sections into which the city is divided, it being possible by this means to connect up a certain locality or cut it out without interfering with the remaining parts of the city. The dynamos supplying the different districts are also known, so that it is a comparatively easy matter to regulate the lighting. Placed against the posts and lettered to correspond with the dynamos, are the controller magnets. At one end of the dynamo room, Fig. 2, are the general, private and directors' offices, the office of the superintendent of the station and the lamp testing room.

From this station 1,000 arc lights in different parts of the city, as well as a number of series incandescent lights, are operated, and power is also furnished to a good many motors employed for running sewing machines, light lathes, fly fans and blowers for blowing church organ bellows, operating pumps, elevators, etc., the number of applications for electricity for power purposes being largely on the increase. The staff employed in the operation of this station, which has about fifty miles of wire out, and is one of the largest in the country, consists, in addition to the superintendent, of several office clerks and collectors, and a storeroom clerk, two night and two day engineers, two firemen, a coal purser, and two oilers in the dynamo room. Out-of-doors the company employs in the maintenance of its wires, poles, etc., and in making new connections, three linemen, four laborers or helpers, a driver and twelve lamp trimmers. The number of the latter has to be doubled during the winter months, owing to the necessity for more frequent attention to the lamps. Among the company's patrons, in addition to the municipality, there are a number of private arc and incandescent circuits, hotels, stores, etc.

The Manufacture of Arc Light Carbons.

A number of special dispatches have reached New York with regard to the movement made last week by representatives of local lighting companies, as reported in these columns, to undertake the manufacture of carbons for themselves. We give the dispatches below:

ST. LOUIS, June 23.—The two St. Louis companies engaged in the manufacture of carbon wire were startled this evening by the publication of the proposed action of the electric companies. They are the Parker-Russell Mining and Manufacturing Company, of 711 Pine street, and the American Carbon Company, of 809 South Seventh street. The joint product of these two establishments is about 12,000,000 carbons a year, of which the larger quantity is produced by the Parker-Russell Company. The total production in the United States is about 50,000,000, so St. Louis has an interest of nearly 28 per cent. in the trade in this country. This is the distributing point for almost the entire territory west of the Mississippi, and the business has increased and is increasing rapidly every year with the increased popularity of the electric light. Mr. Fishback, of the Parker-Russell Company, said: "The situation, as far as the carbon companies are concerned, is just this: A short time ago a man named E. C. Hawks, having an interest in the carbon company at Buffalo, N. Y., went about the country making an effort to form a carbon trust something like the Standard Oil Trust. He succeeded in leasing most of the factories. He did not lease our factory, but entered into a contract to take all our product at a fixed price. I believe he made the same arrangement with the American Carbon Company. He furnishes all the supplies, and if we want anything we order it from him. You see if this combination against us is formed, Mr. Hawks, and not we, will suffer."

"What is the term of your contract?"

"That I would not care to say, but it is a long one."

"What other carbon companies are there in the United States to be affected by this combination?" "There are the Brush, the Boulton, the National, the Cleveland, the Forest City, the Crystal and the Globe, of Cleveland; the Pittsburgh and the Solar, of Pittsburgh; a company at North Adams, Mass., and the Wallace Carbon Company, situated somewhere in Connecticut."

"Will the combination of electric light companies affect the price of carbons and the rental of arc lights?" "It may affect the price of the carbons. They are pretty high now. A fair price for them is $15. The cost of the carbon is so small a factor, though, that I hardly think it will affect the cost of the light to consumers; the fluctuations in carbon prices never have in the past."

"Does your raw material come from the Standard Oil Company?"

"We use various materials for different styles of carbon. All our raw material comes through Mr. Hawks, and I do not know where he gets it."

CHICAGO, June 23.—Concerning the electric light carbon monopoly, the formation of which was disclosed in the *Times* this morning, F. W. Cushing, of the Chicago Arc Light and Power Company, said to-day: "When the combination raised the price of carbons on us, we wrote to Europe to see what arrangements could be made for importing a supply. We have not yet received a reply. There has also been some talk of our going into the manufacturing business, but nothing definite has been decided. We use about 50,000 carbons a month, so the increased cost makes considerable difference to us. To the public, however, it makes no difference. We charge 50 cents a night for each light. This is 20 cents cheaper than in New York, and is the same price as was charged before the price of carbons was raised. A light burns one and one half carbons every night. Now, at $20 per thousand these only cost 2 cents each, or 3 cents a night. The lighting companies have to stand it. We can get poor carbons now for $15 per thousand, but they would be expensive at $10. They burn only five hours, while a good carbon burns seven hours."

CLEVELAND, O., June 23.—The announcement in *The Times* to-day that electric light companies have organized a syndicate for the manufacture of carbon points and obtained control of the petroleum coke product was a surprise to the manufacturers here. The seven carbon companies in Cleveland have a million dollars invested in plants and employ about 400 men. Five of them are in the combination or trust known as the United Carbon Company. Representative men of all these concerns say they have contracts for coke enough to supply them for three years or more, and meantime may find some other material suitable for making carbons. In case the electric syndicate engages in the manufacture they expect to compete in prices as long as they can remain in the field. As David A. Dangler, of this city, trus-

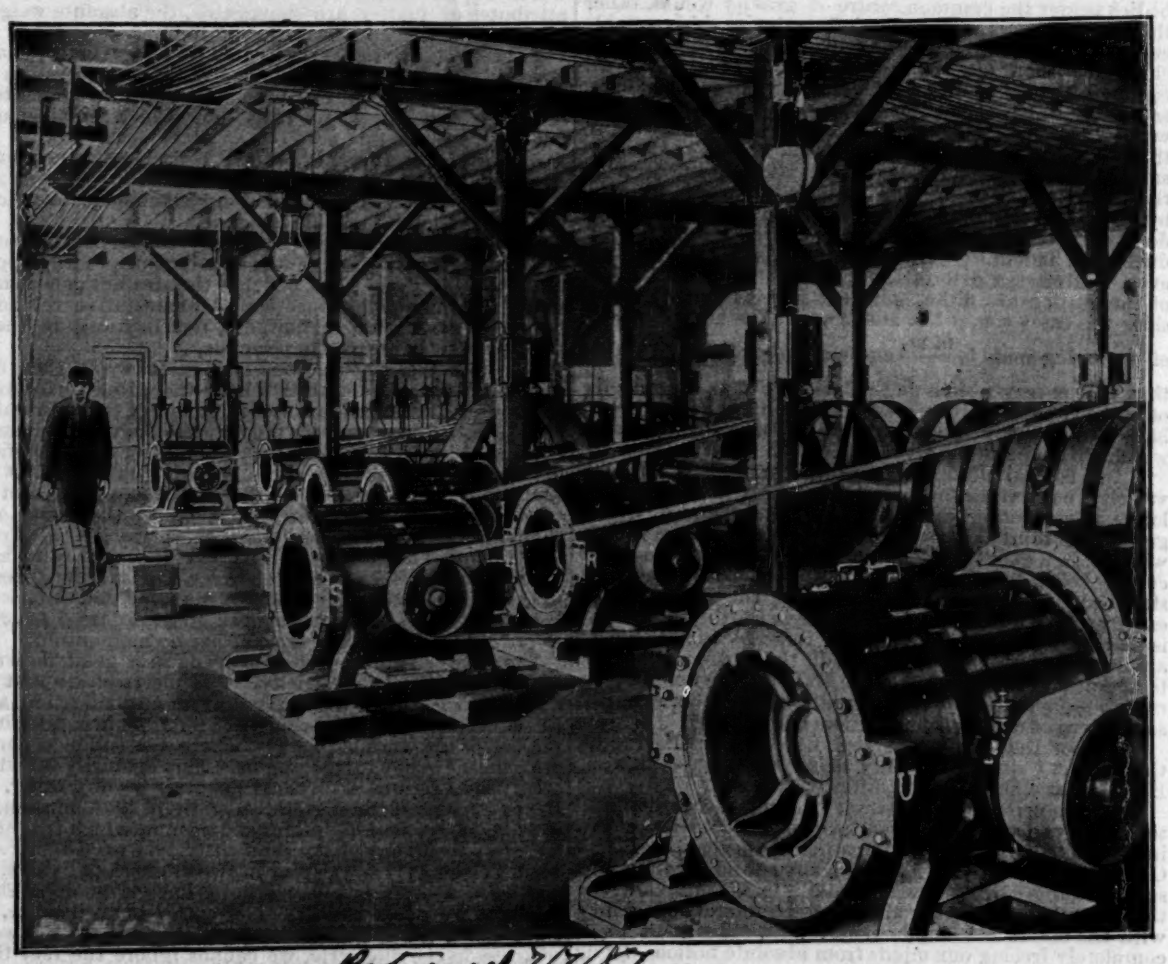


FIG. 2.—DYNAMO ROOM, CITIZENS' STATION, BROOKLYN.

tee of the United Carbon Company, is intimately connected with the Standard Oil Company, they are skeptical upon the report that the Standard will sell its entire product to the syndicate.

CLEVELAND, June 24.—The Cleveland carbon companies interested in the United Carbon companies received this afternoon from Silas H. Paine, manager at New York of the Western sales department of the Standard Oil Company, a telegram denying that the electric light men have conferred with the Standard, declaring that no offer has been made to dispose of the entire product of petroleum coke, and closing with this assertion: "We know of no reason why we shall not be prepared to supply the article in the future as in the past."

What is Electricity?*

BY TOWNSEND WOLCOTT.

It is a common statement that energy can neither be created nor annihilated, and that the total energy in the universe is a determinate quantity. The first part of this statement, although true, is not in itself of vital importance, while the latter part is not true. It is perfectly true that neither time nor space can be created or annihilated, and yet nobody attaches special importance to this fact, or says anything about the conservation of time or space, and certainly nobody ever tried to prove as a corollary that the total amount of time or space in the universe is a determinate quantity.

The true value of this principle of the conservation of energy is, that it is the expression of the quantitative relations of phenomena. Nearly all, if not all, phenomena consisting of change, or succession of events in time, are referred to force; now we find that all measurable forces have a definite quantitative relation to each other (the correlation of forces), such that the disappearance of one kind of activity, change of position, etc., of material bodies cannot take place without the appearance of an equivalent amount of some other form or forms of activity, etc. This it is that makes the conservation of energy the keystone of modern science. It is the modern equivalent for the old cause and effect.

Potential energy may always be expressed as the line integral of a force. When the force follows the law of inverse squares, as in gravity, electric and magnetic attraction, the integral is finite even when the upper limit of integration is infinite, providing the lower limit is finite; but if the lower limit is zero the integral is always infinite, and, therefore, the potential energy (in case of attraction but not of repulsion) of a finite system, is infinite. If we have a system of attracting bodies, say, gravitating masses, this infinite value will represent what may be called the total potential energy of the system, but the bodies having come into actual contact, if we suppose them incompressible, have parted with all their available potential energy, the other part corresponding to the dissipated energy in the theory of heat.

Now this available energy where the bodies vary in size, shape, density, etc., is different for every final arrangement, as the closeness of final contact would depend on this; also the arrangement which brought the denser bodies nearer the common centre of gravity would, other things being equal, give the greater value to this available energy. As the order of approach of the bodies may be changed without altering the amount of energy, we must conclude that the latter is either infinite or indeterminate, according to which measure of energy we adopt. Maxwell states that "the existence of a potential function, in the field near an electric current is not a self-evident result of the principle of the conservation of energy," as the potential has an infinite number of values differing by $4 \pi i$, so that an indefinite amount of work may be done on a magnetic pole which is carried round the conductor an indefinite number of times. The work, however, is always a determinate quantity when the limits of integration are finite, as in the previous case. I consider the cases somewhat analogous. The kinetic energy of a moving mass is $\frac{m v^2}{2}$, and we sometimes see it stated that this energy resides in the body. But as the velocity of a body is merely relative, this kinetic energy will have a different value for every other moving body with which we compare the given one.

If two bodies collide, they will, in coming to a common velocity, convert all their available energy (available relative to each other) into some other form, and if we regard some third body as a standard of reference, there will still be a quantity of energy dissipated, the amount of course being different for each different body taken as a standard. The reason why the idea of the dissipation of energy has assumed such importance in the theory of heat is that the energy of a hot body is referred to a so-called absolute zero of temperature; but this being below the temperature of interstellar space, so far as we know it, we can no more reach it experimentally than we can the absolute zero of contraction mentioned above.

Professor Dolbear, in his reply to Mr. Carl Hering on this subject,† speaks of energy as an objective condition. Here is just where I would differ with him.

Energy is certainly an abstract concept, a class-designation for a variety of forms, and we in these times believe in the philosophy of Aristotle rather than that of Plato. Or to come down to later times, Kant considers time and space as subjective impressions, and it is in this category that I would place energy also, from its interchangeability with the others as a fundamental unit. To assist us in completely freeing our minds from absolute notions, let us consider a remark made by Prof. Augustus De Morgan, in an article on the "Calculus of Functions." Namely, that we are accustomed to regard quantity as being generated by the successive additions of *equal* increments; thus an hour is considered as the sum of sixty equal parts called minutes, a minute of 60 seconds, and a second may be considered as composed of an indefinite number of smaller equal parts. This is the most natural process for the human mind, but conceive of a mind to which the natural process would be to consider quantity as generated by the successive addition of *percentage* increments; to such a mind what to us is the theory of logarithms would be the common arithmetic, and what we express as $a + b$ would be a difficult operation. In fact, it was by employing this conception of kind that Lord Napier discovered logarithms and not by the extended conception of exponents, as is sometimes supposed. I have given Prof. De Morgan's meaning from memory and do not quote his words.

Let us apply a similar method of analysis to the theory of fundamental units. Maxwell gives length, time and mass as the three fundamental units on which all others are made to depend. These units, however, are fundamental only in a relative sense, as we may take other magnitudes as fundamental, and make, length time and mass depend on these.

The most general statement of the theory is that three independent units having been established; all other physical units may be made to depend on these, reducing the whole to a connected system.

Space, or the more specialized conception, length and time, are among the earliest abstract notions acquired by the human mind, but with mass the case is different. It is only since the general adoption of the principle of the conservation of energy that the conception of mass has attained its present distinct individuality, it being in fact a more refined substitute for the "weight" of the older science. The *vis viva* of Newton (which was equal to twice the kinetic energy) was not mv^2 but $\frac{wv^2}{g}$, w being the weight and g the force of gravity. Energy then has at least an equal title with mass to the position of fundamental unit, on the ground of being in the natural order of our mental processes. We may, therefore, substitute energy for mass, and using E as its symbol and Maxwell's notation, we have the dimensions of the unit of mass $[E\,T^2\,L^{-2}]$; and in fact the only definition of mass we have, which is at all characteristic, contains this formula by implication.

We may define mass as that which possesses weight or attraction for other masses; but it is only when we add that a mass moving with a given velocity is capable of doing a definite amount of work that we obtain any distinctive idea of mass. Instead, however, of substituting energy for mass we might substitute it for either length or time, and conceive of a mind, according to Prof. De Morgan's method, to which this would be the natural order.

Again, we always think of a velocity as the ratio of a distance to a time, but there is no reason why we should not regard velocity as an independent magnitude, and a time the ratio of distance to velocity; or a distance, as the product of a velocity and a time, according to which substitution is made. Now, according to the statement in Professor Dolbear's article, that energy has an objective existence as well as matter, of which the measure is usually considered mass, and ether, which as yet has no measure, we may construct a system of fundamental units of which one or two are the measures of objective realities, while the remaining two, or one, are merely subjective impressions. If the ether had an independent measure we might take mass, energy and ether as fundamental units, making all three objective, or, adopting the vortex theory and discarding mass, we must take in again one of the merely subjective magnitudes to fill its place. This proposition, to my mind, is a good deal like saying that one of the dimensions of space has an objective existence while the others have not. Preceding the discovery of the conservation of energy was the discovery of the indestructibility of matter, and in some of the older works on chemistry it is stated that while all other attributes of matter are changeable, the absolute weight remains unchanged under all conditions.

As the weight is only determinate under determinate conditions, it has been recommended that conservation of mass should be substituted for indestructibility of matter, mass being considered the only thing which remained unchanged. But is this correct?

All the chemical properties of a body have determinate magnitudes when a sufficient number of conditions are fixed, and the whole method of volumetric chemical analysis is founded on this principle.

I have gone thus at length into the general theory of conservation to show that it does not necessarily apply alone to energy and mass, but that the abstract generalization from any complete series of quantitative relations between measurable magnitudes, not included in these two, is a new conservative principle.

For if it were not a conservative principle then the magnitudes would not always have the same quantative relations. Conservation is the statement of the uniformity of nature, or, if you prefer the expression, the constancy of natural law. I will add that the conservation of energy is so broad a principle that nothing outside of it is likely to be of very great importance. From this point of view it is no more than we should expect that some one should establish a conservation of electricity, as Prof. Sylvanus P. Thompson seems to have done, nor is it any proof that electricity is matter, as Mr. Carl Hering appears to think. The most direct proof to my mind that electricity is not matter, is the experiment of Maxwell, tried in 1861, to prove that the electric current has no momentum.

The answer to our question depends in a great measure on the definition of electricity. The electrostatic unit of quantity is identical with the unit of electrification, and the electrification of an insulated conductor in equilibrium is all upon the surface; that is, where the conductor ends and the new conductor begins. This quantity of electricity is as definite a physical quantity as any other, as the operations of measurement, addition and subtraction may be *experimentally* performed upon it, which is all that we can do with any physical quantity. We may, therefore, regard electricity as existing in two dimensions (which, by the way, matter has never been known to do). Still, whether we adopt the theory of action at a distance, or Faraday's theory, mathematically developed by Maxwell, of stress in the dielectric, we cannot ignore the fact that there is a definite distribution of force in the surrounding space, which is investigated in the theory of potential. Let us take the analogy of a shadow. A shadow in ordinary language is a darkened *surface*, but this darkened surface is merely a section of a darkened *region*, and it is this darkened region that is called the shadow in astronomy. The superficial shadow cannot exist without the solid shadow, and, on the other hand, the solid shadow cannot exist without there being a superficial shadow on a properly placed surface. Of course, to us a shadow is a mere negative, the absence of light. But suppose some one to be investigating it, not knowing that it was only a shadow, he might regard the superficial phenomenon as the direct action at a distance of the opaque body, or he might assume an ether with all sorts of convenient properties, and explain matters in that way. But we regard the superficial and solid shadows as merely different phases of the same phenomenon.

The trouble with our question as usually put is, that we define electricity as we have just done, then insist that this is the genuine article, and fundamemtal in its nature, while all other phenomena, which are essentially electrical, are merely consequences of this fundamental quantity of electricity, and then we demand, What is electricity? That is to say, which of three or four other things that we allow to have a real existance, viz., matter, energy, etc., is it. I would answer emphatically it is no one of them.

Let us abandon absolute ideas and treat all electrical phenomena as equally fundamental, simply striving to discover their relations to each other and to other phenomena: then each discovery is a partial answer, and the only kind of an answer we will ever have to our question. As to our present knowledge of the subject, it is as great as of any other subject in natural science. Indeed, Maxwell says in his preface: "The internal relations of the different branches of the science which we have to study are more numerous and complex than those of any other science hitherto developed."

I have often put the counter question to my friends, What is heat? The unscientific ones usually say, "Heat? Why anybody knows what heat is; there is no use of such a question!" Or, "Heat is heat;" or, "Heat is the opposite of cold." Those that have read Tyndall reply very glibly that heat is a mode of motion. But Tyndall's book only proves, and indeed only sets out to prove, that heat is a form of energy. We know that electricity, as we define it, is not energy; but we do know what its relation to energy is, which is just as important and characteristic knowledge as we have in the case of heat.

* Abstract of a paper read before the New York Electrical Society.

† See THE ELECTRICAL WORLD, May 7, 1887.

On a New Class of Voltaic Combinations in which Oxidizable Metals are Replaced by Alterable Solutions.*

BY DR. C. R. ALDER WRIGHT AND MR. C. THOMPSON.

It appeared to the authors probable that just as a liquid capable of parting with oxygen, chlorine, etc., can be used in conjunction with an electrode of unchangeable material at one side of a voltaic cell (as in Grove's nitric acid battery and analogous combinations), or may be replaced by a solid conducting electrode, itself capable of losing oxygen (*e.g.*, a plate of strongly compressed peroxide of lead), so, conversely, might a conducting plate of oxidizable material (*e.g.*, zinc) at the other side be replaced by an unchangeable electrode in conjunction with a liquid capable of taking up oxygen, chlorine, etc., without producing any fundamental change in the character of the actions taking place in the cell while generating a current. The electrode immersed in this oxidizable substance, like the zinc of an ordinary cell, would acquire the lower potential, and the opposed plate the higher potential; *i. e.*, the wire connected with the latter would be the "positive pole" of the construction in reference to the external circuit.

On trial, it has been found that such is the case, and that in consequence a large variety of novel forms of cell becomes easy of construction. For example, sodium sulphite or potassium ferrocyanide solution opposed to chromic-sulphuric acid solution; preferably with an intermediate layer of some neutral salt solution, such as sodium sulphate, to prevent the direct action of the two fluids on one another. During the passage of a current, sodium sulphate or potassium ferrocyanide is formed in quantity proportionate to the electricity passing, *i. e.*, to the amount of silver thrown down in a silver voltameter included in the circuit; whilst chromium sulphate is produced at the other side. Various analogous cells are described, in particular one where lead oxide dissolved in caustic soda is opposed to alkaline hypobromite. In this case lead dioxide is produced and separates out in the solid form; and one where chromium sesquioxide dissolved in caustic soda is opposed to chromium trioxide dissolved in sulphuric acid. Here sodium chromate and chromium sulphate are formed, an E.M.F. about equal to that of a Daniell cell being set up.

In the discussion which followed, Mr. Page said that after listening to Dr. Wright he was able for the first time to understand how electric currents might arise in the animal body.

Dr. Alder Wright said, in reply to Mr. Page, that the experiment suggested of opposing venous and arterial blood had not been actually tried by him as yet, but he thought it quite probable that a weak current might be produced. [The President subsequently said that he had been told that a current was produced on opposing venous and arterial blood.] By opposing alkaline pyrogallol solution to oxidizing agents, notable currents could be developed; and various other organic compounds might be used instead of pyrogallol. With certain organic bodies, however (*e. g.*, chloral hydrate), attempts to produce oxidation in cells had hitherto failed. The opposition of acid and alkaline fluids alone would not necessarily produce more than infinitesimal currents; Becquerel's "*pile à oxygene* (nitric acid opposed to caustic potash solution) gave rise to decomposition of nitric acid and evolution of oxygen from the electrode immersed in the alkali; other authors had found that analogous cells with chromic-sulphuric acid instead of nitric acid would behave in the same way and develop a continuous current capable of doing external electrolytic work such as deposition of silver in a voltameter; on the other hand, a cell in which caustic soda and sulphuric acid only were opposed (so that chemical action other than neutralization could not take place) would only develop an infinitesimal current through a silver voltameter, capable of depositing only traces of silver even after some days, although its E. M. F. measured by an electrometer was considerable.

With regard to the observations of Dr. Armstrong, Dr. Wright said that while without doubt Grove's gas battery was the prototype of the class of cells discussed, inasmuch as that combination was virtually an oxidizable solution of hydrogen opposed to an oxidizing solution of free oxygen, still the examination of cells in which other oxidizable fluids were used instead of hydrogen solution, and other oxidizing substances besides solution of oxygen, was a branch of experiment in which hardly anything had hitherto been done, and which seemed to merit some little attention. The authors desired to study in detail the general behavior of certain typical classes of cells in which actions of the kind take place, especially from the point of view of elucidating the precise chemical changes

*Abstract of paper read before the English Chemical Society.

going on and their relations to the amounts of electrical (or current) energy developed. Whilst there was not exactly a probability of any very startling discovery being made, there were still a number of points of interest connected with the subject worth examining; and although the hope of an improved primary battery based on actions of this kind for commercial use, as suggested by the president, was perhaps not yet within measurable distance, yet the problem of economically obtaining current energy by direct chemical action (and especially by oxidation) was one now attracting considerable attention, and it was impossible to predict what might or might not be the result of systematic experiments tending in that direction. The importance of obtaining practically usable currents

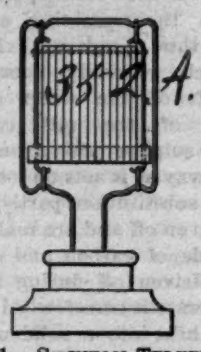


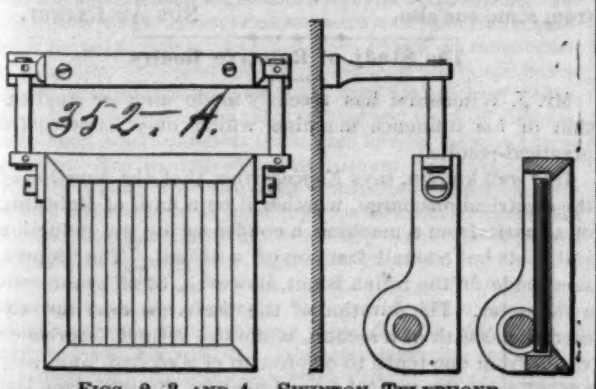
FIG. 1.—SWINTON TELEPHONE.

from coal direct without the use of the steam engine and dynamo could hardly be over-rated should it hereafter be found practicable so to do; and in view of the compactness of the animal machinery, whereby the oxidation of fuel in the form of food gave rise by muscular action to mechanical energy, it did not seem to be of necessity hopeless to attempt to solve such a problem.

The Swinton Telephone.

There has recently been brought out in England by Mr. A. A. C. Swinton, a telephone transmitter, which it is asserted contains neither diaphragm, tympan, nor the equivalent of either. The breath of the speaker impinges directly on the carbon rods of the microphone, setting them into motion by direct impact of the air without any intermediary whatever; and to place these rods beyond suspicion of receiving motion from the supports, they are arranged in a leaden frame suspended from fixed brackets by india-rubber bands. The rubber bands cut off all vibrations from the framework, while the lead is too heavy and too inelastic to respond sensibly to the stimulus of waves of air set in action by the voice.

The accompanying engravings illustrate the transmitter. Fig. 1 shows an early form in which the microphonic contacts are mounted in a light wire frame standing upon a heavy foot. The carbon pencils there shown are strung on a platinum wire, Fig. 4, which passes horizontally through them, near their upper ends. They are hung slightly out of the vertical, and at their lower ends rest against a horizontal carbon rod. The speaker places his mouth a few inches from the rods and directs his voice towards them, the vocal impulses causing them to press with greater or less force against the lower carbons, and thus to offer less or more resistance to the passage of the electric current, as is well understood. Figs. 2 to 3 show the transmitter as now made. It is constructed with a rectangular frame of lead suspended by two india-rubber cords from brackets projecting from the face of the board, on which are mounted the call bell, push button, receivers and other accessories (Fig. 5). The ears to which the india rubber cords are connected are adjustable in order that the frame may be tilted forward to such an angle as is found to give the most suitable pressure between the vertical pencils and the horizontal rod. In any



FIGS. 2, 3 AND 4.—SWINTON TELEPHONE.

case this pressure is extremely slight, the pencils hanging almost in equilibrium and responding most readily to the voice of the speaker.

The receivers are of the *English Mechanic* type, this name being given by reason of this form of telephone having been disclaimed from the Bell patent on account of prior publication in the *English Mechanic*. The central magnet is a core of soft iron excited by the main current which circulates in the coil at its end. As the current strength varies, in accordance with the pressure on the microphonic contacts of the transmitter, the attraction of the magnet on the piece of iron in the centre of the diaphragm experiences corresponding changes, and sets up vibration in the diaphragm, as is well understood.

The general arrangement of the apparatus is shown in Fig. 5. At the top is the call bell, which is operated by the push button from the other end of the line. Below the bell comes the transmitter, and at the bottom are two receivers. These are supplied in duplicate, as hearing is greatly assisted by having external sounds cut off on both sides of the head, and also because the two parallel paths, which they offer to the current, serve to reduce the sparking at the contacts. The receivers are hung upon hooks, one of which operates a switch to put the bell in circuit when the telephone is suspended in place. The removal of the receiver from the hook cuts out the bell and puts the instrument itself to line. A battery at each end completes the equipment, which is said to be capable of giving satisfactory results over a line of many miles in length. As the instruments are wound to be operated only by direct currents they scarcely feel the effect of induction, and consequently it is claimed the wires may be run on telegraph poles without inconvenience.

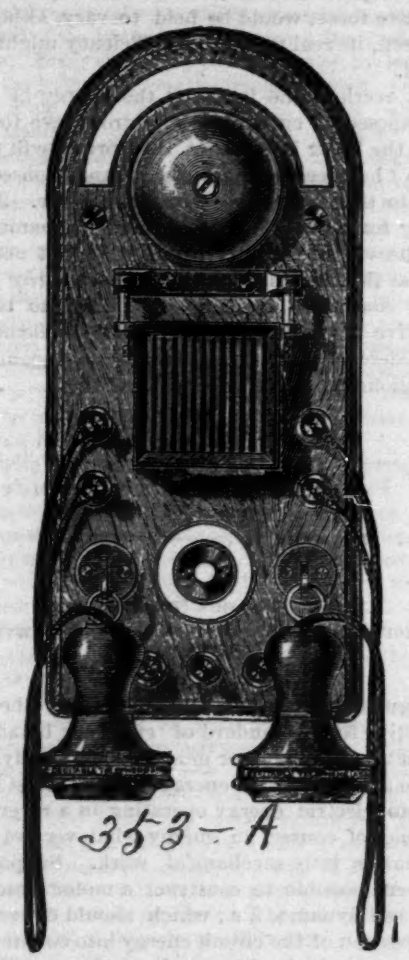


FIG. 5.—THE SWINTON TELEPHONE.

The Phœnix Storage Battery.

The Phœnix accumulator, the invention of Mr. Phillimond Bailly, a French engineer, is made in two distinct types, viz., with lead-lead and zinc-lead plates, the liquid in either case being, as in most secondary batteries, dilute sulphuric acid.

The lead plates used in both types are constructed in the same manner. The active material of these plates consists of fine lead wool. This material has been used before for the same purpose, but has failed, owing to the difficulty of conducting the current from the mass of lead wool to the terminal of the battery. This difficulty is obviated by the following device: A sheet of lead, which also acts as the conductor, is cut into coarse filaments or tapes in the manner of a fringe, Fig. 1, which is woven or interlaced with the smaller filaments of the lead wool which composes the electrode. The arrangement may be compared to the arteries and arterioles which permeate the human body. These lead plates are "formed" entirely by electrolytic action; they become, in fact, Planté plates, having an enormous surface, the peroxide of lead assuming a beautiful hard crystalline condition.

In the lead-lead type of the Phœnix accumulator, the plates above described are packed together with special porous diaphragms of sand, consolidated under great pressure, and of great porosity, between them, to keep them apart and prevent short circuiting. The alternate plates are connected together by means of the strips protruding from the lead fringes, and the whole, forming a compact mass, is placed in the cell destined for its reception.

In the zinc-lead type, the negative pole consists of a specially prepared amalgamated zinc plate which dips either into a cup made of celluloid and containing mercury, or in the circular forms as shown by Fig. 2, into the conical bottom of the porous pot, in order to keep up the amalgamation of the zinc and collect the mercury liberated by the discharge. The negative pole of this battery consists of a copper wire covered with gutta-percha, which passes down through the liquid, and makes contact with the zinc plate below the surface of the mercury in the cup. One of the lead electrodes, described above, is wrapped round the porous pot and forms the peroxidized plate of the battery, Fig. 2. The engraving shows a portable cell of this type, the case being made entirely of celluloid, a material very largely employed in the construction of these accumulators for lining the interiors of wooden boxes and for various other purposes. It will be noticed that the porous pot is itself conical in shape at the bottom, thus rendering a special wooden cup for the mercury unnecessary. These cells have a capacity of 50 ampère-hours and weigh about 14 pounds with acid. The electromotive force of the zinc-lead cells is about 2.5

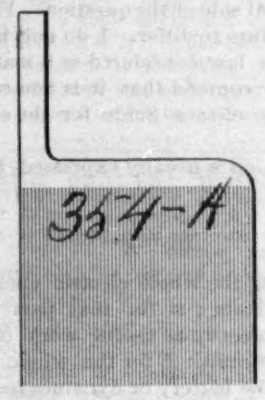


FIG. 1.—PHŒNIX STORAGE BATTERY PLATE.

volts on open circuit, falling to 2.33 when a discharge is taken.

The action of the zinc-lead cells is as follows: In discharging, the zinc plate dissolves in the dilute acid, forming sulphate of zinc; on the other hand, when the battery is being charged, the sulphate of zinc formed during discharge is decomposed, metallic zinc being deposited on the zinc plate. The zinc is thus never consumed, but only dissolved and re-deposited. The action, as regards the lead plate, is precisely similar to that in the Planté battery and need not, therefore, be described here. The same remark applies to the lead-lead type of Phœnix accumulator.

The efficiency of the battery is said to steadily improve up to a certain limit, and to remain there. Owing to the mass pressed between the plates, buckling and short-circuiting is entirely avoided, and owing to the large surface presented to the liquid by the filaments, the cells can be discharged at a very high rate. The internal resistance is very low, the porous pots and plates being made of a specially porous material. The electromotive force of the zinc-lead cells is 2.5 volts.

With a rapid discharge, the E. M. F. descends in a proportion depending on the internal resistance of the cells. For instance, ten zinc-lead cells of 100 ampère hours capacity, 9 in. by 4¼ in. by 9 in. deep, give the following results:

Rate of discharge. Ampères.	Electromotive force. Volts.	Rate of discharge. Ampères.	Electromotive force. Volts.
2.3	25.5	18.9	20
3.2	25	21.9	19
4.5	24.5	26	18
5.8	24	28	17
8.2	23	31	16
10.9	22	34	15
15	21	40	14

The cell gives 7 ampère hours per pound of plate, or 9 ampère hours per pound of lead wool. The following

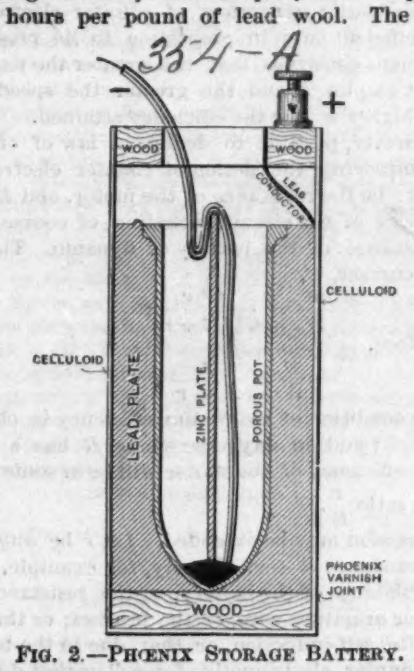


FIG. 2.—PHŒNIX STORAGE BATTERY.

table of weight, capacity, etc., of the cells is given by the makers:

Capacity in ampère hours	50
Weight complete with acid	17 lbs.
Maximum normal discharge	10 ampères.
Dimensions (external)	14 in. × 5 in. diam.
Capacity in ampère hours	100
Weight complete with acid	45 lbs.
Maximum normal discharge	30 ampères.
Dimensions (external)	11 in. × 10½ in. × 4½ in.

Underground Wires in Washington.—A special dispatch of June 28, from Washington, says: "The work of laying 17,000 feet of underground telegraph cable for the use of the District fire alarm and telegraph service has just been completed, and a number of poles will be taken down. The work was done in a remarkably short time."

The Efficiency of Electric Motors.

BY STEPHEN H. EMMENS.

Inasmuch as electric motors are destined to be largely used in every department of industry, it becomes a matter of importance to determine the conditions under which they can be employed to the best advantage. Most electricians will probably maintain that this has already been done and that the law of efficiency stated in the abstract by Thomson, Joule, Rankine, Jacobi and Verdet and practically developed by Siemens, represents the last word upon the theoretical side of the question. From this opinion I humbly venture to differ. I do not, indeed, dispute the accuracy of the law considered as a mathematical expression, I merely contend that it is sometimes misleading when made use of as a guide for the construction of electric motors.

The law in question is usually expressed by the following equation :

$$\frac{w}{W} = \frac{e}{E},$$

where W stands for the whole electric energy developed per second by a current ; w for that part of the energy which the motor takes up as useful work (measured electrically) from the circuit ; E for the whole electromotive force with which the battery or dynamos feed the motor, and e for the counter electromotive force generated by the motor.

Under this law the condition of maximum efficiency is obviously when $w = W$, and when, therefore, $e = E$. But when $e = E$ no current can pass, and no energy can be be developed; so that we are led to the strange conclusion that an electric motor is most efficient when it is not being worked. I am aware that the usual way of expressing this is to say that an electric motor is most efficient when it is being run at a speed high enough to generate a counter electromotive force equal to the electromotive force of the current employed to run it; but this is surely a *petitio principii*, it being affirmed that a motor *can* be run under such circumstances, whereas the practicability of this is the very point that needs proving.

In like manner a motor is said to be least efficient when supplied with a maximum current of electricity, the reasoning being that such maximum current will pass only when the counter electromotive force is nil—*i. e.*, when the motor is standing still. Again, therefore, we have a *petitio principii*, it being assumed that a motor *can* stand still under such circumstances, the very possibility that needs proof. Indeed, the argument is commonly decorated with the stipulation that, when the maximum current is passing the motor is to be fastened so that it cannot move !—a stipulation which I am perverse enough to understand as meaning that the motor shall, for the nonce, cease to be a motor.

The difficulties here appearing are owing to the introduction of the term "counter electromotive force." It is true that a motor when driven by an electric current *tends* to generate a current in the reverse direction. It is also true that the faster the motion the greater this tendency becomes. And as this tendency, multiplied by the volume of the current against the flow of which it is directed, forms a convenient electrical measure of the energy taken up by the motor, electricians have come to regard motors as being *essentially* generators of counter electromotive force and efficient only in proportion to its production. Hence Siemens construes that the greater the tension of the current employed and the greater the speed of the motor the higher will be the efficiency attained.

It is, however, possible to deduce a law of efficiency without employing the notion of counter electromotive force. Let r be the resistance of the motor, and R that of the remainder of the circuit, including, of course, the internal resistance of the battery or dynamo. Then, for any given current, C,

$$\frac{w}{W} = \frac{C^2 r}{C^2 (R + r)};$$

and, therefore,

$$\frac{w}{W} = \frac{r}{R + r}.$$

Here the condition of maximum efficiency is obviously where $R = 0$; and in any case where R has a positive value the efficiency of the motor will be in some proportion to the ratio $\frac{r}{R}$.

The expression may be extended. Let r be *any part* of the total resistance $R + r$. It may, for example, be the internal resistance of the battery, or the resistance of the line wire, or armature wire, or the brushes; or the resistance due to self-induction, or that due to the tendency named "counter electromotive force ;" or that due to the magnetization of the cores, or due to the mechanical force exerted by the motor; in fine, any particular element of all those that go to make up $R + r$. In each of these cases w stands for the energy taken up in overcoming the particular resistance ; or, as I prefer to say, used up by being transformed into some other kind of energy, such as light, heat, sound, magnetism or mechanical force. And in each case we have $\frac{w}{W} = \frac{r}{R + r}$ as the equation of efficiency and $\frac{r}{R}$ as its variable ratio.

Nor is the law confined to the case of electric motors. It is equally true in the case of a lamp circuit. It is even applicable to the working of a steam engine. It is a general expression for every kind of physical mechanism. This cannot be said of the equation $\frac{w}{W} = \frac{e}{E}$ which is applicable only to the case where r stands for the resistance due to counter electromotive force—a case quite outside of practical requirements. What the *user* of an electric motor is concerned with is its efficiency from a *mechanical* point of view. For his purposes it is an apparatus for transforming the heat of a boiler furnace or the chemical action of a galvanic battery into mechanical work at some distant point ; and the more or less completeness with which this transformation is accomplished is the measure of its efficiency. Hence the only case in which he seeks to apply the foregoing law is where r stands for the resistance due to the useful mechanical time-work performed by the motor ; and if there be any resistance due to counter electromotive force he relegates it to the waste total represented by R.

Now, mechanical time-work is represented by the product of the mass moved and the space-time or velocity at which it is moved. Hence, a motor may do the same work by either moving a light load at a high speed or a heavy load at a low speed. And since the work is performed at the expense of the electric energy transmitted through the circuit, it follows that the percentage of the electric energy transformed into useful mechanical work, or, in other words, the efficiency of the motor, may be the same in both cases. But counter electromotive force, as produced by a revolving armature, depends upon velocity alone. Therefore, in the case of a circuit supplied at a constant electromotive force—from a battery, for example —the efficiency of a motor, if measured by the counter electromotive force, would be held to vary, although, as we have seen, its real mechanical efficiency might remain unchanged.

I do not overlook the fact that the energy of the circuit is composed of current and electromotive force, and that when the latter is constant the former will vary according to the speed of the motor, and, consequently, according to the counter electromotive force. All I am contending for is that the proportion of mechanical work done, to the electric energy supplied, is not necessarily the same as that which *the counter electromotive force of the motor considered as a dynamo* bears to the main electromotive force of the circuit. If *every* element were to be considered, physical laws would all become identical expressions, as in the present case, where

$$\frac{r}{R + r} = \frac{w}{W};$$

$$\text{and } \frac{e}{E} = \frac{w}{W};$$

$$\text{and, therefore, } \frac{r}{R + r} = \frac{e}{E};$$

$$\text{or } \frac{C^2 r}{C^2 R + C^2 r} = \frac{Ce}{CE};$$

which latter equation is only another way of writing—

$$\frac{w}{W} = \frac{w}{W}.$$

The argument may also be put thus: If the counter electromotive force standard of efficiency be adopted, it follows that a perfect motor must be a perfect dynamo, in which case all the electric energy supplied must be transformed into electric energy operating in a reverse direction, leaving, of course, no energy whatever available for transformation into mechanical work. Suppose, however, it were possible to construct a motor which should be a very bad dynamo, *i. e.*, which should convert a very small proportion of the circuit energy into counter electromotive force, and should transform the remainder into mechanical work. Would not this be a much more efficient motor for practical purposes than that in which $e = E$?

What is required in the designing of electric motors is to determine the manner in which the *mechanical power* is generated. If the transformation of electric energy into mechanical force be effected through the intervening stage of magnetism, then the problem resolves itself into one of constructing the most efficient magnetizing apparatus ; and it seems to me that this is very different from constructing the most efficient dynamo. Good motors are doubtless made upon the bases of electro-dynamic action, high armature speed and high-tension currents ; but may not still better machines be constructed on the principle of high magnetization and no distinction between field magnets and armatures?

A New Negative Element for Leclanche Batteries.

In a patent recently issued to Victor Francken and Edouard Bender, of Belgium, there is described a new compound to be used as the negative or carbon element in the Leclanché battery, and which is said to overcome some of the difficulties met with in the use of the latter, being especially more durable.

The compound consists of the following elements : Peroxide of manganese, 40 per cent.; graphite, 44 per cent.; tar, or equivalent material, 9 per cent.; sulphur, 0.6 per cent.; water, 6.4 per cent. These substances are reduced to a fine powder and thoroughly mingled, and during this mixture the water is gradually added. This damp mixture is then put into molds, preferably metallic, so constructed as to give the desired form, and, without heating, are thus molded. The press may be a single or a double one—that is, have one or two compressing-pistons, as desired. These bodies may likewise be formed by forcing them by pressure through an aperture and cutting them off in suitable lengths, as is done in the formation of electric-light carbons. The conglomerate bodies so prepared are sufficiently solid to be handled without difficulty. They are allowed to dry spontaneously, and are then put into a furnace or oven, where the temperature is gradually raised to about 350 degrees centigrade. This temperature is insufficient to decompose the depolarizing bodies, since peroxide of manganese only decomposes at a red heat, say from 600 degrees to 700 degrees centigrade ; but this heat is sufficient to drive off the volatile parts of the mixture, and to transform the remaining conglomerate into the new product thus produced. During this gradual heating, which generally occupies about two hours, what is left of the water evaporates. Then the most volatile of the oils contained in the tar, and, finally, the sulphur acting on what remains of the tar in the same way as it acts on other hydrocarbons, changes the tar by substitution partly into volatile products, which are driven off and are rendered manifest by the odor of sulphide of carbon and other sulphureted products which are driven off during the heating. The rest of the conglomerate is transformed by the action of the sulphur and the heat into a solid unattackable body. The action of the sulphur on the tar is very similar to its action in the vulcanization of india-rubber.

Output Per Pound of Copper.

To the Editor of The Electrical World :

SIR: Among the great number of subscribers to the WORLD there must be a good many who, like myself, are not experts, to say the least. It is for the benefit of such that I offer these suggestions to those who know more.

In the discussion about the output per pound of copper in armatures, that has appeared lately in the WORLD, there seems to me to be a lack of exactness. I may be wrong, but so far as my reading and limited experience go the value of an armature does not depend on the weight of copper at all, but upon its relative resistance.

If, now, Messrs. Dobbie and Rice (especially the latter) had given the size and length of wire used, and the resistance of the armature quoted, the value of their data, as to efficiency per pound of copper, would have been of more use to those of us who are not experts. Also, the kind of magnet coils used, whether series, shunt or compound. All these things are probably plain to experts, and perhaps I am the only one who is so ignorant as not to see it all. If so, I beg the pardon of the rest.

Another thing I would like to ask of Mr. Wheeler, or some one else, and that is, Why, when the current is reversed in the C. & C. motor, the armature does not reverse its motion?

A short time ago I was exhibiting a C. & C. motor and a Van Depoele motor, each ½ horse-power, and run by a C. & C. battery. For convenience, as I wished to run sometimes one and sometimes the other, I led conducting cords from the binding screws of the C. & C. to the Van Depoele, so that by loosening one binding screw I could switch the current on to the Van Depoele at will. As long as the C. & C. ran only at a moderate speed, there was nothing different from what I planned, but on raising the speed of the C. & C. to 1,200 or 1,500 revolutions, the Van Depoele started too and continued to run at a very fair rate of speed. This could not be due I think to a shunt current, for the cords leading to the Van Depoele motor were of fine wire and long enough to give more resistance than the motors.

It was a surprise to me to see the other start and I am not fully satisfied with my theory. I would like to hear from some one else. NOT AN EXPERT.

The Study of Rotative Bodies.

Mr. J. Wimshurst has recently made another application of his influence machine which may have useful practical results.

It is well known, says *Engineering*, that the duration of the electrical discharge, whether it be a flash of lightning or a spark from a machine, a condenser or an induction coil, lasts but a small fraction of a second. The impression made on the retina is not, however, of so evanescent a character. The duration of the discharge does not exceed the ,0001th of a second, while the retinal impression varies from one-tenth to one-fourth of a second, and may according to the careful experiments of Plateau, even last one-half a second. It is in consequence of this persistency that a series of separate impressions are blended into one, producing thereby all the effect of absolute continuity.

On the other hand, a very rapidly moving body when illuminated for an exceedingly brief period of time must appear clearly delineated and perfectly stationary, because the duration of the illumination is but a small fraction of the time occupied by any part of the body in moving from any one position to the next following. Hence the clearness with which each of the colored sectors of a revolving Newton's disc appears when lit up by an electric discharge.

Mr. Wimshurst has turned these observations to account in the construction of a piece of apparatus which may be

eminently useful in studying the behavior of any machine or body while in a state of very rapid motion.

The beauty of the arrangement is its great simplicity and the facility with which it may be adapted to any rotating body whatever. The whole novelty lies in the construction of what may be called the commutator. In its simplest form this consists of a copper wire twisted round the spindle of the rotating machine, and carrying at its extremities two small brass knobs placed at unequal distances from the centre of the spindle. Opposite these, and independent of the rotating body, is a second pair of knobs, which are directly connected to the terminals of a Wimshurst or other static electrical machine. Once in every revolution of the rotating body, the two pairs of balls come near enough to each other to allow the electric discharge from the influence machine to pass. In every other position the distance between the knobs exceeds the striking distance and no spark passes. Hence any desired portion of the rotating body is flashed into view once in every revolution; and, owing to the instantaneous nature of the discharge, that particular portion which is illuminated appears perfectly motionless. If the speed of the body be increased, the frequency of the electric discharges will be increased in the same proportion, and for high speeds especially, the part of the rotating body under examination will be permanently visible and will appear absolutely stationary. Any other section of the machine may be submitted to the same analytic scrutiny by merely turning the commutator into the corresponding position.

The apparatus of Mr. Wimshurst was shown recently at the Royal Society soirée, and subsequently at the Royal Institution. On both occasions it attracted much attention. Mr. Wimshurst used his box multiple plate machine, which furnished a current equal to the $\frac{1}{18000}$th of an ampère with but very little expenditure of muscular energy. The discharge was so brilliant that the effects could be distinctly seen without lowering the gas in the apartment in which the experiments were made.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
June 27, 1887.

The trial of Mr. Nevins, Chief Engineer of the Brooklyn Fire Department, for "grand larceny," ended very suddenly last week in the acquittal of the defendant. The District-Attorney as prosecutor sought to prove that the franchise for electric lighting had been granted after the defendant had received money from those interested, and he based the indictment on the statements made recently before the Investigating Committee. Mr. Henry W. Pope was called in support of the charge, but the judge said that as a matter of law the defendant was not guilty of any crime, and therefore as a matter of law and common sense there could not in the face of the facts be any justification for the indictment. A verdict was thereupon ordered immediately for Mr. Nevins, and thus the case ended. It would hardly be safe to say, however, that nothing more will be heard of the matter.

The Tucker Electric Manufacturing Company, 35 Broadway, is now preparing to storm all the citadels of electric engineering. It has its plans well matured, and its staff of experts ready. It will introduce all kinds of electrical apparatus, and will itself undertake the engineering and contract work. It will pay special attention to incandescent lighting.

The Empire China Works, 144 to 156 Green street, Greenpoint, Brooklyn, have been in existence for a number of years manufacturing porcelain goods of all kinds. They are paying special attention to porcelain electric supplies for indoor and outside use generally. Among their standard lines are plain insulators and knobs of all sizes, from ½ inch to 2 inches, push buttons, cleats, circuit breakers, switch bushings, battery insulators, battery rings, mouthpieces for speaking-tubes and other varieties.

I see that Eimer & Amend, the great manufacturing chemists and dealers in chemical supplies, are comfortably settled in their beautiful new building, Eighteenth street and Third avenue. The structure is of light cream brick and terra cotta, and for that reason, if for no other, is a very conspicuous object on the avenue; but it is moreover notable for fine architectural points, and has on its front some remarkably good terra cotta medallions of leading physicists. Inside it is admirably laid out and is full of chemists, electricians, experimentalists and a large force of clerks and warehousemen. The departments in this business that may particularly interest electricians are quite numerous—thermopiles, glass ware, batteries, exhaust or vacuum pumps for making incandescent lamps, testing apparatus, crucibles in every conceivable style and shape, globes, bulbs, vats and all the raw chemicals.

Mr. Robert Gilmour, 82 John street, is a manufacturer of asbestos materials, and contractor for covering steam plants with hair felt, asbestos plaster, asbestos paper, felt, etc. Mr. Gilmour has been connected with this business a long time and is fully conversant with its many important details. Electric lighting plants are a specialty with him, and I believe that he covered the first Edison plant at Menlo Park. He can now refer to several hundred installations in all parts of the country. He finds asbestos coming more and more into vogue as an insulator, and it seems to me that its non-conducting qualities might be more thoroughly investigated than they have been. I do not see why asbestos compound of some kind could not be employed as insulation to wires, and, in fact, I believe there is already a demand of this kind. Asbestos can be had in sheets of all sizes, and in a variety of guises.

In such hot weather as we are having now it is hardly necessary to recommend fans, but it seems to me that we are apt to forget that there are places where fans are necessary for ventilation, even in the depth of winter. Not only in living rooms and offices, but in factories and damp chambers, there are poisonous fumes which must be carried away, such as are encountered in the use of acids in plating vats. I was very much struck with the range of application of the fan when in 50 Cliff street the other day looking at the Wing fan, and when looking at the Blackman fan, 58 Fulton street. Both these can be run by electric motors, either by belt or directly coupled up. If you are in a district covered by wires from any electric lighting station, all you have to do is to have the wire tapped at the nearest point, put on your motor, and there you are. In case it is not possible to run from a street circuit, storage batteries or primary batteries can be used.

Mr. E. L. Bradley, an electrician of quite wide acquaintance and reputation, is now at the Planters' Hotel, St. Louis, making inquiries with a view to a western office for the Tucker Company above mentioned.

Hazazer & Stanley, of Frankfort street, have just brought out their new "lock seam" speaking tube, elbows, whistles and mouth-pieces for their department of house-fitting.

Mr. A. B. Laurence, 82 John street, reports very large sales of cotton leather belting for Edison, Schuyler, Westinghouse, United States and other plants.

Governor Hill has vetoed the bill taxing "bucket shops," not on the ground that the principle is unjust and obnoxious, but because the tax was to be exacted irrespective of amount of business done and discriminated against those residing in certain cities. The governor has also signed the New York Subway Bill, in spite of the opposition to it of the local authorities and two of the political organizations, and on the ground that it is of the utmost importance that the wires in this city should go underground as soon as possible.

The Electrical Accumulator Company of this city report business as remarkably good. The introduction of electrical accumulators or storage batteries has recently extended electric lighting by incandescent lamps to private residences. In Boston Mr. F. L. Ames is, I believe, the first to equip his house with a complete electric light plant. His house is one of the largest and finest in Boston, and will be supplied with more than 450 lamps, as it has been decided to dispense with gaslight, and illuminate the house from attic to cellar by electricity. Men are now at work laying the wires, and the installation will be completed in ample season for the return of the family in the autumn. The drawing-room, music-room, library and dining-room will be lit by lamps hanging from the ceiling, giving a beautiful effect, only to be obtained with electricity. In the halls and many of the chambers the present gas fixtures will be converted into electric fixtures, and a few combination fixtures will probably be used. To supply the necessary current, a small Edison dynamo and 10 horse-power gas engine in the basement will be run a few hours two or three days in the week to charge the accumulator cells. There will be about 250 cells, which will supply current for any or all of the lamps at any hour of the day or night, in the same way that a reservoir filled at intervals by a pump will give a continuous supply of water. The accumulators will be placed in a dark closet under the front steps, and the engine and dynamo in a small basement room adjoining. The entire plant is being put in by J. T. Moriarty, 19 Pearl street, Boston. This installation will be the largest and most complete in any private residence in this country.

The Electrical Accumulator Company is also having a yacht built at Newburgh, N. Y., to be propelled by its cells. It will be 37 feet long, 7 feet wide and 5 feet deep. At present the work has not progressed far enough for the publication of details. You have already made note of the plans of the Isolated Accumulator Company, which is to introduce the E. A. cell in New York, Brooklyn and Westchester, and I may add that L. C. Kinsey & Co. are introducing the cells to be used in connection with central station lighting in Reading, Allentown, Bethlehem, Philipsburg, and other towns in the Keystone State.

The Electric Time Company are actively improving the fleeting seconds by the introduction of numerous regulators, secondary clocks, tower clocks, etc., with many new features. They have a regular central station in the city of Brooklyn, where are kept only the batteries and supplies, and from which all the large number of secondary clocks and regulators are run, giving uniform time to bankers, brokers, lawyers, hotels, storekeepers, etc. They are now putting in several tower clocks in New York and Boston. They offer special inducements to established messenger, district, telegraph, telephone, electric light and similar companies for the introduction of their system throughout the cities of the United States.

They have established a company in Boston which is controlled by representative men of means and ability, for furnishing electric time generally. The company, I understand, have begun business under the most favorable auspices and the demand for clocks has surprised the originators beyond their most sanguine expectations. The home company are increasing their facilities for making large tower clocks, also large clocks for banks, exchanges, halls and various desirable places. The Electric Time Company's offices are at 16 and 18 Broad street, N. Y., and they have a local office 26 Court street, Brooklyn, besides their central station and factory.

I learn from Mr. Goff that the combination of electric lighting and gas is working very successfully at Saratoga Springs. About six months ago the Saratoga Gas Company and the Electric Lighting Company there, using the American system of electric lighting, were combined under one organization. The electric light plant consisted of one hundred and twenty-five arc lights and about three hundred incandescent lamps. The electric lighting has become so popular in Saratoga that the company is now increasing its arc light plant. An addition to fifty lights has just been ordered from the American Company which will be installed and in operation in about ten days. It has been suggested to the company that the lighting of the avenue from the Grand Union Hotel to the race course, as well as the racecourse itself, so that during the hot weather the racing could be held in evening, would be a very great attraction. Whether this will be done this season or not is yet undecided, but it is being very carefully considered. If the trotting association should decide to use electric lights it will be one of the greatest attractions, as well as one of the greatest novelties in Saratoga.

The "Fall of Babylon," the great summer spectacular piece at St. George's, Staten Island, produced by Mr. Erastus Wiman and the Kiralfys, is a tremendous sensation and a big success. Everybody is talking about it. Nothing finer in the way of spectacular art has ever been produced around New York. Five acres of stage and a thousand performers, backed by colossal scenery and inset by a glorious blaze of electric light—this is the tableau laid out every night before 20,000 spectators. The success is largely a triumph of electric light. Arc lamps are used profusely, and the concentration is obtained by a special arrangement of large projectors. These lights are furnished by the American Company. I hear that Mr. J. J. Wood, of that company, has given the work his personal attention, and has thus added another to his notable successes in the field of special lighting—one being the Statue of Liberty, where the American system is in nightly use, shedding its beams athwart the gay shores of Staten Island. The American system is also employed at Erastina for Forepaugh's big show. I may add that at St. George's upward of 1,000 Edison lights are used with excellent effect, and that the general disposition of the whole spectacular lighting was wisely intrusted to the supervision of Mr. Luther Stieringer, whose skill and taste in these matters is proverbial. It is perhaps a little significant that an attempt was made to aid the arcs with some calcium lights. One might as well have tried to supplement the sunshine itself.

W. T. H.

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
BOSTON, June 27, 1887.

Mr. Alexander Bernstein, whose name is familiar to every reader of THE ELECTRICAL WORLD, is now on a visit to this country. Mr. Bernstein arrived in Boston June 23.

Messrs. Beckman & Punchard, of the Parker House, in this city, are the first to install in a hotel the Rogers system of auxiliary fire alarms, which is being introduced here by the Boston Auxiliary Fire Alarm Company. The Parker House has been thoroughly equipped with this company's system of instantaneous alarms, by which, in case of fire, by the pressing of any one of the electric buttons or switches which are distributed upon all the floors of the hotel, an alarm is instantly "pulled in" from the fire-alarm box located on King's Chapel, and communicated within one second to every engine-house in the city. Mr. Osborne Howes, secretary of the Boston Fire Underwriters' Union, and Mr. A. H. Kelsey, superintendent of the Boston Tariff Association, with other gentlemen, were, on Friday last, invited to inspect this system at the Parker House, and to witness its practical operation and effect. The exhibition proved entirely successful and satisfactory, and alarms were rung in from every part of the great hotel. The protective value of this (the Rogers system of auxiliary alarms) against the loss of property by fire has been established by a material reduction of the insurance rate on the Parker House by the Boston Fire Underwriters' Union on account of its introduction there. Upon the discovery of a fire, disastrous delays in sounding alarms are frequent, and are largely owing to the time required in getting to the nearest street box, obtaining the key and opening the box. Under the Rogers system its auxiliary boxes are within easy and immediate reach in every part of a building, and at the Parker House an alarm can now be rung in and one or more engines brought to the hotel within two minutes from the pressing of any one of the electric buttons. A number of other hotel proprietors have applied for the auxiliary alarm, and their houses will be fitted and connected with the street boxes as rapidly as the work can be done.

The Jarvis Engineering Co., this city, have received the order for the third Armington & Sims engine for the Newton Electric Light Company, Newton, Mass.: to set three boilers with the Jarvis boiler setting for the Middletown Electric Light Company, Middletown Conn.: and to set the fifth tubular boiler for the New Haven Electric Light Company, New Haven, Conn.

The Boston & Maine Railroad has adopted the Gould-Tisdale electric signal. A new time-table has just been issued by this railroad for the use of its engineers, conductors and station agents, to take effect immediately, and in it is an illustrated description of the signal referred to.

Advices from Fall River, Mass., state that Mr. John Beattie has organized a company in that city with a capital of $1,000,000, for the purpose of manufacturing a combination of zinc and mercury for use in telegraph, telephone and other batteries. Mr. Beattie is the inventor under whose patent the new corporation will conduct its business.

South Framingham, Mass., people are agitating the important question of connecting their city with the towns of Marlboro and Hudson by a belt line of electric railroad. The distance is about four miles. It is said the proposed scheme is well advanced and that Boston and New York parties are interested in the enterprise.

The financial column of the Boston Sunday *Record* (June 26) has the following: Higher prices, say 40, are predicted for Erie Telephone on the strength of excellent management and large earnings. By the way, Erie is always spoken of as a 2 per cent. stock. But last year an extra dividend was thrown in, making 2½ per cent. in all. What is to hinder doing the same this year, even if the quarterly dividend is not increased?

Bell Telephone sold this morning at from 219 to 219½. The instrument output of the company for the month ending June 20, and for the first half of the fiscal year, commencing Dec. 20, 1886, is just issued, and shows in comparison with last year as follows:

MONTH ENDING JUNE 20.

	1887.	1886.	Inc.
Gross	6,971	4,581	2,390
Returned	1,598	1,216	382
Net	5,373	3,365	2,008

SIX MONTHS—DEC. 20 TO JUNE 20.

	1885-86.	1886-87.	Inc.
Gross	26,663	21,635	7,028
Returned	11,114	9,262	1,852
Net	17,549	12,379	5,176

The regular directors meeting of the American Bell Telephone Company occurs early in July. The announcement of an extra dividend will probably be made at that meeting.

The Leatheroid Manufacturing Company of Boston (factory at Kennebunk, Me.), recently received a cablegram from the Edison Machine Works, of Paris, France, for 1,000 pounds of shoe leatheroid.

The Salem, Mass., Electric Light Company has declared a quarterly dividend of 1½ per cent., payable July 15.

The Mather Electric Company, of Hartford, Conn., through its agent, E. P. Sparrow, of Boston, has completed the installation of the following isolated electric light plants: 100 arc lights at the mills of the Richards Paper Company, and 50 arc lights at the mills of S. D. Warren & Co., both at Gardiner, Me. It is

also reported that the Mather Company has its men at work erecting and equipping a central station for incandescent lighting at Houlton, Me.

Information is received that the Woonsocket (R. I.) Electric Machine and Power Company, of Woonsocket, has come to a final understanding and agreement with Wyman & Chace, who have been running the mills lately purchased by the Electric Company. Wyman & Chace have decided to hire for three years mills Nos. 2 and 3, the two next to the Bernon dam. Here Wyman & Chace will slash yarn sent from Valley Falls and weave it in No. 2 mill. The Electric Company will occupy old No. 1 mill, in which will be placed all their machines. The dynamos will be either on the second or third floors, and the room will be free from belting, as they will be run from undershafts connected in the room below.

The sale of the American system of electric lighting in the New England States is increasing so rapidly, it is said that the company have decided upon opening a branch office of their business in Boston. A portion of the building occupied by the Boston Electric Light Company, 107 Congress street, has been rented for offices and warerooms, which will be fitted up immediately for this purpose. The business will be under the supervision of Mr. Homer J. Goff, late general manager of the Merchants' Company in Boston, and Mr. Samuel Elder, formerly of the firm of Sowdon, Elder & Wright, the former general agents of the American Company in New England, with Mr. Goff and Mr. Elder as managers, and Maj. L. B. Wright as mechanical engineer. Mr. Sowdon has retired from the firm for the purpose of devoting his time to the management of his private interests in various local companies using the American system, and in further extending them. Mr. Sowdon has lately associated with him some strong capitalists, with a view to investing largely in local electric lighting companies using the American system.

Mr. J. T. Moriarty, Boston representative of the Electrical Accumulator Company of New York, has commenced wiring the residence of F. L. Ames on Commonwealth avenue, Boston, for upward of 400 incandescent electric light lamps, dispensing entirely with gas light. The current will be supplied by about 250 accumulator cells charged by an Edison dynamo run by a ten h. p. gas engine. The accumulators, dynamo and engine will be located in the basement. W. I. B.

PHILADELPHIA NOTES.

PHILADELPHIA, Pa., June 27, 1887.

Experiments were made recently at the Harrison Boiler Works in this city with the Hamilton Ruddick machine for pulverizing coal for fuel and also in using waste coal, which were very satisfactory and which showed a saving of 30 to 40 per cent. in using pulverized coal over the ordinary method of burning in the lump. The process of pulverizing the coal and delivery to the fire-box are simple and inexpensive, the coal dust being driven in by an air blast, affording an ample supply of oxygen with the coal-dust to form perfect combustion. A large flame and intense heat are produced by a remarkably small quantity of coal. The principal object aimed at by the inventor was to devise a means of utilizing the millions of tons of waste or culm coal in the extensive coal regions in this State. This is admirably accomplished, not only by the machine, which has been patented, but it has been clearly demonstrated that there is great economy in pulverizing lump coal for fuel.

The importance of the discovery, not only to mills and factories, but to all who use any quantity of fuel, cannot be overestimated.

The seventy-three employés of the Electro-Dynamic Company have presented to the directors of that concern a memorial, returning their sincere and hearty thanks for, and grateful appreciation of, the Saturday half holiday, which was recently given them, principally through the efforts of President Griscom and Secretary Paul. No deduction of pay is made, and the order will remain in force until some time in September, the works shutting down at noon every Saturday.

Mr. J. R. Simpson, who has been the Philadelphia agent of the Mather Electric Light Company, of Hartford, has lately resigned his position with that company and has accepted a position with the American Electric Manufacturing Company of New York as a Philadelphia and Eastern Pennsylvania agent. Mr. Simpson is doing remarkably well for the American Company, having closed several very important sales within the past few weeks. About three weeks ago he established a 50-light American plant at Atlantic City, which is working so successfully that the owners have decided upon doubling the capacity, the apparatus of which has been ordered and shipped.

Mr. Joseph Stickney's new yacht "Susquehanna," being built by Harlan & Hollingsworth, at Wilmington, which will be launched shortly after July 1, will be fitted with 135 incandescent lamps, with accumulators and storage batteries of 500 lamp hours capacity. There are few yachts or few first-class passenger steamers built on the Delaware nowadays that are not furnished with electric light plants, and for that matter, all modern railway trains are being fitted up in the same way, the new Pullman vestibule train on the Pennsylvania Railroad being the most notable instance of the kind. The storage batteries were put up by the Electrical Accumulator Company, of New York, and when the train completes its trip to this city they are taken to the Electro-Dynamic Company's works and recharged, while another series is put in to take their place on the next trip. So far they have proved a great success.

Several stores and restaurants were fitted up last week with revolving fans, some being furnished with power by the United States Electric Lighting Co., and some being run directly by small Baxter engines, a large number of which are being used in this city not only for this purpose, but in various places where a small amount of power is needed. One restaurant has a 2 h. p. Baxter engine in a second story back room, and this supplies power enough to run a number of fans on each floor of the building. In the winter they will be used for other purposes, and as insurance companies charge no extra premium on account of their use they are becoming decidedly popular. With these and other small and compact engines, and turbine water-wheels, it is probable that a large number of private residences will have isolated electric light plants and revolving fans put in very shortly.

The rapid transit question in this city is so all-absorbing that little or nothing else had been thought of during the past few weeks. The arguments pro and con fill column after column of the local papers each day, and mass meetings are being held, mostly to protest against the elevated railroad scheme. It is impossible to tell how the matter will end. Incident to the agitation, any number of schemes have been brought out, including electric, pneumatic, underground, and every imaginable form of transit. The warm weather seems to have no effect upon the matter, and some action will probably be taken by city councils before long. E.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
CHICAGO, June 25, 1887.

A year ago Mr. Yeaton, of St. Louis, went to Kansas City and organized the Southwestern Electric Supply Company, of which he is now president. Heretofore this trade has been controlled mostly by Chicago. Mr. Yeaton has organized a strong company, and has associated with him Mr. Lasell, a young man of well-known ability. Through the courtesy of these gentlemen, I was shown recently around the establishment, in which are kept on hand a supply of the most popular kinds of material suitable for electrical plants of all descriptions. This company makes a specialty of electric lighting supplies, and enjoys a large city and country trade.

My next call was at the office of the Western Electric Construction Company, 521 Delaware street, of which Mr. W. D. Macquesten is the general manager. The company are the authorized agents for the Edison Electric Light Company. They have already installed a number of plants in Kansas City, and judging from the energy they have heretofore displayed we may expect great results from their work in the future. I understand that the company are now considering the question of entering largely into the supply business.

I had the pleasure of meeting Mr. Stocker, formerly telephone manager at a small exchange in Kansas, and who has always been known as an energetic and conscientious student of electrical science. He is now the owner of several valuable patents, and is engaged in forming stock companies, in order to place his inventions properly upon the market. In conversation with Mr. Stocker I learned that the Atchison, Topeka & Santa Fe Railway Company have equipped one of their suburban trains with his electric signal and electric air brake releaser. The object of this latter appliance is to overcome the objection which has always been found with the ordinary air brake in working slowly when the air is released from the cylinders. The air brake releaser is operated by the engineer, using a push button which closes the circuit on an electro-magnetic valve (of which there is one connected with each brake cylinder), which opens, in operation, causing the instantaneous release of the air from the cylinders upon all the cars. This valve is an auxiliary to the triple valve of the ordinary air brake, and by the use of it the sticking of the air brake is positively avoided. Another point in this appliance is the fact that by the use of it the air pump is continuously supplying the air pressure, as the work of the brakes is effected by the electro-valves, and there is no necessity for discharging the air from the train pipe. This is claimed to be of great advantage in applying the brakes on long heavy grades. The signaling system is operated by the trainmen by means of an ordinary push button in the coaches, which will close the circuit, blowing an electro-magnetic air whistle on the locomotive and at the same time ringing a bell in each coach.

Mr. Stocker also has a new motor of very high efficiency. The idea in this appliance is to use air pressure instead of steam is the motive power. Of the several other inventions of Mr. Stocker, the following are among the most important: automatic danger signal of peculiar construction for railway trains; electric head-light for locomotives; electric station indicator for railway trains, and an electric bell, by which a heavy stroke can be effected without the use of any mechanical contrivance. Mr. Stocker is now using the gelatine primary battery in the signal system, but will use storage batteries as soon as received. The storage battery that he has chosen for this purpose is the one manufactured by the George F. Card Manufacturing Company of Cincinnati.

My next call was upon Mr. George T. Hewes, the genial superintendent of the Home Telegraph and Signal Company of Kansas City. Mr. Hewes has been giving his attention for several months past toward the working out of a scheme by which the problem of locating messengers at all times could be solved. He now announces the fact that he has adopted a plan, which, upon several months trial, he has found to work in a highly satisfactory manner, and at the same time has effected a large saving in messengers' salaries. It is an unusual occurrence to see messengers loitering upon the street. Their time is limited, and they know the precise minute when they are due at the office. The systems in use by twenty-five of the principal cities in the United States were carefully studied, and the following plan adopted: Mr. Hewes made a map of the city drawn to a scale of 300 feet to the inch, then divided the same into sections, each section being given a number. The streets were arranged in alphabetical order and the numbers arranged so as to take in a certain district. Each section is priced and in the compilation of the tariff sheet the section, rate, time allowed and distance are given. There is also a letter indicating which street the messenger must take, and denoting what line of street cars. The tariff is very simple and easily learned by inexperienced boys. The fact that there are no mistakes made in computing the tariff is of itself a great advantage. The public are at all times charged at the same rate to a given point. The company, by the use of this system, has effected a saving of eight messengers at one station at which there were heretofore employed eighteen messengers.

The University of Kansas has established a course in electrical engineering, the first term beginning the following September. This university has purchased at large cost a complete laboratory.

Coming home to Chicago, I can report that I had the pleasure of attending the opening of the Lake View Electric Light Company's Diversey street Station on Thursday evening last. One hundred arc lights were arranged in circuit, and fastened to the ceiling of the building. The opening was a success in all respects, and many hearty well wishes were expressed for the success of the company.

Prof. C. H. Somers, electrician of the Western Union Telegraph Company, is taking a vacation.

The St. Catharines, Ont., Merriton and Showell Street Railway Company are equipping their line with the Van Depoele Electric Railway system and hope to have it running in September.

Mr. Paul W. Bossart has closed a contract with Mr. J. D. Bowersock, of Lawrence, Kan., for a 100 light incandescent plant of the Mather system, for use in the Lawrence Opera House.

The Chicago Electric Club gave their first banquet at the Grand Pacific Hotel, Saturday evening, June 11. There were 48 gentlemen in attendance, representing, with a few exceptions, the entire electrical interests of Chicago. Gen. A. K. Stiles presided, and the dinner was highly successful in every respect. A vote of thanks was extended to the entertainment committee, and the success of the club pledged heartily by every member present. There is reason to suppose that the Chicago Electric Club will, before many years, have its own club-house and be in a position to entertain its friends as agreeably as any other local electrical club in the country. The organization is composed largely of highly energetic and capable young men, who see in the success of the club the more rapid development of their own business interests.

Mr. W. J. Buckley, manager of the Chicago office of the Ft. Wayne-Jenney Electric Light Company, tells me that his company is about to install a 50-light plant and an incandescent system in the large drygoods house of Siegel, Cooper & Co. The Toilet Supply Company, of Chicago, are building a central station at Wabash avenue and 16th street, which will have a capacity at the start of 130 arc lights, Ft. Wayne-Jenney system. The Ft. Wayne-Jenney Electric Light Company have also contracted to light the 12th street bridge with 7 arc lights.

The Lafayette, Ind., city council passed a resolution last week depriving the Central Union Telephone Company of all privileges heretofore granted, unless they conformed with the laws of the State in charging tolls. The council considers the ticket toll system another evasion and has decided not to countenance it.

The Elkhart, Ind., telephone subscribers have refused to accept the toll system.

Complaint has reached me that the plan of charging five cents for each connection by the Telephone Company in Indianapolis is not satisfactory. I am told that in some cases the tolls received do not pay the rental on the instruments. Under the present system subscribers are obliged to buy so many tickets each month. A petition is being circulated and very generally signed by the patrons of the company, which is in substance that the subscribers agree to pay the royalty on the instruments semi-annually in advance, in addition to paying five cents for each connection. This petition also makes a request for an automatic registering attachment for each telephone. The telephone controversy in Indiana has, as it is well known, injured business to a great extent, and it would seem that the best thing the subscribers at Indianapolis could do would be to resume the payment of the rates as they existed before the passage of the law.

The council at Galesburg, Ill., has given a franchise to a company to put in a system of 85 arc lights.

A fire in Leavenworth, Kan., June 21, destroyed one entire block of buildings and did much damage to the Telephone Company. The exchange, however, escaped danger as far as the switchboard was concerned. I am informed that a considerable portion of the cable work was destroyed.

Jacob C. Dold & Son, pork packers at Kansas City, have purchased a system of ten lights, heretofore operated by Louis Hammerslaugh, and will install the same in their packing house.

The following is an item of interest from the Chicago *Tribune* of June 25:

Prof. Elisha Gray, of telephone fame, is perfecting an invention with wonderful possibilities, and one which promises great results. It has already reached that stage which insures its practical success, the experiments thus far proving eminently satisfactory. The "telautograph" is the name by which the instrument will be known, which, by the way, conveys a very fair idea of what the instrument really is. Once in operation it will be possible for the Chicago speculator to deliver to his New York broker a telautographic order to buy or sell 1,000 or 10,000 shares of railroad stock, an exact fac-simile of the order being reproduced in that city at the same instant it is written here. If the Chicago man happens to be in New York and wants to send his wife a check for money, he simply writes it out in that city, and the moment he is through it is in his wife's hands here. The electric current, of course, is an important factor in the invention, but the chief feature is the plate or instrument on which the writing is done. No particular kind of pen or pencil has to be used; in fact, a sharp-pointed instrument of any kind, or even a piece of wood, will answer the purpose. The paper on which the writing is done and the autograph reproduced does not have to be prepared, for in the first instance it is the pressure on the plate which gives the impulse to the machine, while the reproduction is brought about by a tracing point, which may be a properly-inked pen or even an ordinary lead pencil attached to a movable arm in the receiving machine at the other end of the line. A number of experiments with the machine have been made at Highland Park, where Prof. Gray's laboratory is, all of them of the most satisfactory character. The circuit was not a very long one, but the tests were of that kind which indicated that the length of the circuit did not matter much and that the work could be done over 1,000 miles of wire as perfectly as over 100. Prof. Gray has not yet applied for patents on the invention, but it is fully covered by caveats, so that he has removed the injunction of secrecy and feels free to talk upon the subject with his friends. He is inclined to think the machine will be required in all cases where absolute accuracy in the delivery and filling of an order is required, and that it will eventually supersede the present system of telegraphic communication; in fact, that an operator will simply transcribe a message, and, while in the act of so doing, will wire it to any point on the continent, the reproduction at the other point always being a fac-simile of the writing of the person at the machine. The attempt was made yesterday to see and talk with Mr. Tripp, Prof. Gray's attorney, who is well posted about his electrical devices and inventions. Mr. Tripp, it was learned, is in Europe, but Dr. J. W. Porter,

who is associated with Mr. Tripp, gave the reporter the information set forth above, adding that Prof. Gray regarded the invention as a more important one than that of the telephone.

Col. S. G. Lynch, broker, 146 La Salle street, Chicago, furnishes me the following quotations upon telephone stock:

Bell of Mo.	$155@$157
Central Union	48@ 49
Chicago	385@ 400
Colorado	20@ 22
Cumberland	80@ 85
Great Southern	30@ 33
Michigan	76@ 77
Missouri & Kansas	75@ 80
Rocky Mountain Bell	40@ 45
Wisconsin	105@ 107

C. H. M.

WARSAW, Ill., June 25, 1887.

The Warsaw, Ill, Electric Light Company was formed about three weeks ago with Col. G. P. Walker, Victor Dory and Conrad Nagel as incorporators. The object of the company is "to operate a system of electric lights of all kinds for the city and citizens of Warsaw, Ill." Its capital stock is $3,000 divided into 60 shares of $50 each, which is held by sixteen of our leading citizens and business men. The affairs of the company are controlled by a board of five directors composed of the following gentleman, M. C. Eckbohm, F. Dross, hardware, groceries and agricultural implements; C. E. Eyman, dry goods; Victor Dory, dry goods; Chas. Albers, secretary and treasurer Warsaw Milling Company. The officers of the company are Victor Dory, president; Chas. Albers, vice-president and general manager; J. B. Dodge, treasurer, and J. Eaton Johnston, secretary, elected for one year. We will use the Brush system, having purchased a 60-light dynamo. Our engine is one of the latest improved Westinghouse of 60 horse-power. We have nearly finished a handsome and commodious frame building, which will be used as the station. It is situated on the banks of the Mississippi River, and close to the track of the Toledo, Peoria & Western Railway, thus giving us facilities for coal and water that are unsurpassed. We start with 35 arc lights, for which we are to receive 25 cents per light per night, which is a lower price than is made by a majority of electric light companies. Six of these lights are taken by the city, the balance by business men at their stores and hotels. Should this undertaking prove a success, we hope in the near future to put in another dynamo for an incandescent plant, as we feel there will be ample room for it.

Two of the large manufacturing establishments contemplate putting in isolated incandescent plants of 50 or 60 lights each.

THE TELEGRAPH.

T. M. B. A.—Assessment 208 for July has been made to meet the death claim of John Dauler and Thos. E. Bohanon.

Mexican Telegraphs.—The Mexican Telegraph Company has declared a quarterly dividend of 2½ per cent., and has a cash balance in hand of $98,000.

Altoona, Pa.—An experiment was made recently at the Pennsylvania Railroad office in obtaining current for the lines direct from the Edison central station. It is said that some such plan will be permanently adopted, thus dispensing with primary batteries altogether, secondaries where possible taking their place.

Order of Railway Telegraphers.—The Grand Division of the Order of Railway Telegraphers held its annual meeting in Chicago last week. About 75 delegates were present. The following officers were elected: Grand chief telegrapher, A. D. Thurston, La Porte, Ia.; assistant grand chief telegrapher, C. J. Coombs, Yates Centre, Kan.; grand chief secretary and treasurer, S. O. Fox, La Porte, Ia.

New Pacific Cable.—A submarine cable across the Pacific from Vancouver to Australia is said to be near to actual accomplishment. The managing director of a new company now in San Francisco is reported as saying: "We will touch at Hawaii and Fiji, having secured a substantial subsidy of $400,000 per year from the Canadian, Hawaiian and Australian governments, of which Hawaii contributes $20,000 per year. The total cost of the Pacific submarine cable will be $10,000,000. The project is now on a firm basis and will be pushed through. Everything has been prepared and the company have registered as required by law."

Railway Telegraph Superintendents.—The next annual meeting of the association of the Railway Telegraph Superintendents will be held at the Tremont House, Boston, at 10 A.M. Wednesday, July 13, 1887. A room has been secured for the exhibition of mechanical and electrical devices used in railway work. Parties desiring to exhibit such apparatus can be assigned space by communicating with L. F. Sheldon, superintendent telegraph, Missouri Pacific Railway, Sedalia, Mo.; G. L. Lang, superintendent telegraph, New York & New England Railway, Boston, Mass.; C. E. Topping, superintendent telegraph, Long Island Railway, Long Island City, N. Y., or with Mr. G. E. Simpson, chairman, the superintendent of the Chicago, Milwaukee & St. Paul, Milwaukee, Wis.

THE TELEPHONE.

Mexico.—The Mexican Central Telegraph and Telephone Company has declared a dividend of two cents per share, payable July 1.

El Paso, Tex.—A miner named Robbins got a verdict recently at El Paso against the Erie Telephone Company for $375 because of an electric shock given him by Miss Belle Hepburn, one of the young ladies in the central office. The proprietor of a saloon opposite the central telephone office had two rings hung from an awning in front, and at just the height to tempt one to "try one's muscle" by drawing himself up. Two concealed wires led to the telephone office. As soon as a man seized the rings, the watchful Miss Hepburn turned on the current and "fixed" him. When Mr. Robbins was released from the rings he had to treat the crowd in the saloon, and was so severely shocked that he was laid up for more than a month. He then brought his suit for $20,000. The verdict was not satisfactory and he has appealed.

THE ELECTRIC LIGHT.

In a Swiss Cathedral.—The cathedal of Coire in the Grisons is to be lighted by electricity.

The Steamer "San Pueblo," running from San Francisco to China, has been equipped with an Edison plant.

Newport, Ark.—An electric light company is reported as being organized. T. T. Ward can probably give particulars.

Macon, Ga.—A bill is to be introduced in the Georgia Legislature to charter the Macon City & Suburban Railway Light and Power Co.

Talladega, Ala.—A New York company, represented by Mr. Steele, will erect an electric light plant as soon as a permit can be secured.

Catskill, N. Y.—The Kaaterskill Knitting Mill, Catskill N. Y., has bought, through Mr. E. G. Bernard, a 150-light Sawyer-Man plant.

Barcelona.—The Sociedad Espanola de Electricidad has been given a contract by the city authorities of Barcelona for certain public lighting for a period of 5 years.

The F. M. Foote Regulator Company, to make electric light apparatus, has been organized at Portland, Me., by A. R. Tinkham and others with a capital stock of $100,000.

New York City.—On June 21 the aldermen referred to the committee on lamps and gas a petition from the Heisler Electric Light Company for a franchise, the company offering to pay 5 cent. of its receipts.

Milford, Mass.—The Electric Light Company, of Milford, has ordered a new arc dynamo, which is made necessary by the extension of its line to Hopedale and in anticipation of an increasing business in town.

St. Petersburg.—The Duma of St. Petersburg has given a concession to the local gas company for lighting streets, houses, etc., by gas and electricity, for a period of 20 years, after which time the gas and electric plants become municipal property.

San Bernardino, Cal.—Mr. Brainard Rorison and Mr. Chas. R. Lloyd, representing the Indianapolis Jenney Company, have been at San Bernardino in connection with the power and light station being put in there by them.

Amador, Cal.—The owners of the Kennedy mine propose to light up their mill and mine with electric light. The South Spring Hill Mine at Amador has been using the electric light for some time with very satisfactory results.

Middletown, N. Y.—The Middletown Gas, Electric Light and Fuel Company, of Middletown, N. Y., was incorporated recently, with a capital stock of $85,000, by Messrs. Alf. Bull, H. R. and H. K. Wilcox, C. Dusenberry, C. Macardell and Wm. B. Royce.

New Bedford, Mass.—A boiler, weighing something over six tons, has just been completed by the New Bedford Boiler Company, for the Edison Electric Lighting Company, at New Bedford. The increasing demand for the popular light calls for more power.

In a California Mine.—The Sierra Brutta Mining Company has contracted with Mr. R. A. Simon for a 30-light incandescent plant for its mine. The Indianapolis Jenney system will be used. If satisfactory results be obtained another plant of 50 lights will be put in at once.

Stafford Springs, Conn.—The Stafford Springs Electric Light and Gas Company, of which mention has been made before, was incorporated by the last legislature, and the parties interested in the company expect to begin during the present season, and put in a plant at once.

New Orleans, La.—The New Orleans Gas Light Company has begun an action in the District Court, looking to the annulling of the contract with the Louisiana Electric Light and Power Company for lighting the streets. The gas company asserts that the contract is in violation of law.

Southbridge, Mass.—The Jarvis Engineering Company, Boston, Mass., have received the contract to install a steam plant for the Thomson-Houston Co., in Southbridge, Mass. They will use a tubular boiler set with the Jarvis boiler setting and a 50 h. p. Armington & Sims Co. engine. They will use saw-dust and shavings for fuel.

Baltimore, Md.—A Sawyer-Man plant is to be installed by Mr. G. F. Patterson for the Columbian Iron Works and Dry Dock Company, Locust Point. The lights are to be distributed throughout the works, in the boiler, blacksmith, machine and pattern shops, drawing rooms and offices. This is the fifth Sawyer-Man plant that Mr. Patterson has installed in Baltimore.

New York City.—Mayor Hewitt has officially approved the franchise granted to the Mutual Electric Illuminating Company by the Aldermen. The new company, under the provisions of its grant, is obliged to pay into the city treasury 20 per cent. of its gross receipts monthly. The Gas Commission will meet at an early date and award the remainder of the contracts for lighting the city.

Utica, N. Y.—The officers of the Utica Electric Light and Gas Company are: President, R. M. C. Graham; vice-president, Henry Keene; secretary, Harold Graham; treasurer, Henry Keene; superintendent, A. W. Putnam Cramer. Directors: R. M. C. Graham, Henry Keene, Harold Graham, Chas. D. Harrison, John Fox, J. P. Miller, John D. Crimmins, A. W. P. Cramer, E. J. Enfer.

Springfield, Mass.—The United Electric Light Company takes the place of the old Springfield company. It will run arc and incandescent lights as usual, and furnish motors for power. It is at present making changes in its engine room, adding another engine of 100 horse-power, and more boilers; and the work will not be finished until August. Mr. J. W. Hyde is the general superintendent and manager.

Pendleton, Oregon.—The Pendleton Electric Light Company was formed last month, with C. S. Jackson as president, and I. C. Shainwald as secretary. It is intended to put in the Edison incandescent system, and the American or Thomson-Houston arc system. Messrs. Mitchell, Sparling & Co., of Seattle, are the contractors. The plant is nearly all ordered, and will be placed on the grounds of the Pendleton Manufacturing Company. The lights will be in full operation by August 1.

Charleston, S. C.—The Charleston Light and Power Company has been organized to succeed the Charleston Electric Light Company, and will build the gas works previously reported as contemplated by the latter company. George B. Edwards is president, and P. P. Toule, secretary and treasurer.

European Theatre Lighting.—Paris is not the only city to insist on the use of electric light in its theatres, music halls, etc. The mayor of Lyons has issued a decree that the theatres in that place are to be lighted by electricity within 5 months. At Madrid the immediate introduction of the electric light in all the theatres has been ordered. In Brussels the substitution of the electric light for gas has been ordered at the Théâtre de la Monnaie.

Cincinnati, O.—From a document received from Cincinnati, it appears, says *Light, Heat, and Power*, that one Charles J. Steinau, for considerations, entered into a contract to light his extensive establishment with gas, exclusively, for a term of ten years from March, of last year. Recently, he undertook to introduce some electric incandescent lamps, and the gas officials had the proceeding stopped. The court upheld the gas company, and decided that the contract was a binding one and could not be violated.

San Francisco.—The Electric Improvement Company, of San Francisco, established a few months ago by some of the wealthy capitalists of the Pacific coast, are pushing their business with a great deal of vigor. A large amount of the American Company's apparatus was shipped last week to the company for installation by two of the largest gas companies on the Pacific coast. The Electric Improvement Company are composed of such capitalists as Mr. Sharon and his associates, among whom are the principal stockholders of the San Francisco Gas Company.

The Waterhouse System.—A pamphlet with regard to its systems of arc and incandescent lighting has just been published by the Waterhouse Electric and Manufacturing Company, of Hartford, Conn. It contains an illustrated description of the apparatus and a number of very complimentary testimonials from persons using the lights. An interesting document is also given in the shape of a letter from Lt. J. Millis to Gen. Newton, Commissioner of Public Works for New York, as to the number of gas lamps displaced and displaceable by the Waterhouse arc lamps of the Harlem Lighting Company. The averages of gas lamps displaced are 6.31 and 5.01.

New Orleans, La.—The Southwestern Brush Company, who were the pioneers in electric lighting in Louisiana, have recently taken steps for adding to their already large business and plant. They have adopted the Westinghouse system for long distance incandescent lighting, and now have contracts for nearly 3,000 lights for the ensuing year. These lights will go, it is said, into some of the largest and finest buildings in the city, as well as in a number of the largest mansions on the residential avenues. Mr. S. H. Bell, the general manager, says that the demand has been so great as to lead to the preparation of plans for further enlargement, so that the central stations shall have a capacity of from 15,000 to 20,000 lights, to be served in all parts of the city.

The Electric Light in Knitting Mills.—The Sawyer-Man Company has just issued a pamphlet containing a number of testimonials with regard to the plants that have been installed by it in a number of knitting mills in this State, by Mr. E. G. Bernard, its agent. The testimonials, of which there are a large number, are very emphatic in showing that perfect satisfaction as to efficiency and economy has been given. In one of the letters it is stated that whereas gas cost at the rate of $83.70 for February, the average cost of electric light for March, April and May, allowing full interest charges, had been only $15 per month. It is noticeable that a number of the plants mentioned are run by water-power.

Boston, Mass.—The Boston Electric Light Company, under the management of Pres. F. A. Gilbert, has become the largest local electric lighting company in the United States. The plant is composed of a consolidation of the Brush Electric Light Company, of Boston, the Merchants' Electric Company of Boston, using the Thomson-Houston system, and the New England Weston, the combination of the three plants making about sixteen hundred arc lights. The company have recently acquired the Citizens Electric Light Company of East Boston, with a capacity of about several hundred lights, the apparatus being built by the American Electric Manufacturing Company of New York. A large increase of apparatus has also just been made, consisting of two hundred and fifty lights, purchased from the American Company.

Brush Lights in the South.—The 450-light incandescent plant at the Sweetwater Park Hotel, Salt Springs, Ga., was fully tested recently and gave entire satisfaction to all interested. The Sweetwater Park Hotel is brilliantly illuminated by means of these electric lamps, the cool, soft lights adding greatly to the attractions at Salt Springs. The plant was sold through the Atlanta agency of the Brush Electric Company, of Cleveland, Ohio, and was installed under the direction of Mr. C. W. Phipps, one of the most experienced electricians on the staff of the Brush Electric Company. B. R. Pitt, of Pensacola, Fla., has ordered for the Pensacola Electric Light and Power Company a No. 7 Brush arc dynamo, furnishing 28 to 30 lamps of 2,000 candle-power. The order was given to Mr. F. A. Rogers, an experienced business and practical man, who is representing the Brush Electric Co. in that section. Mr. Pitt, as president of the Pensacola Co., proposes to push the electric lighting business in Pensacola the coming fall and winter. The Brush electric lighting apparatus for Winston has arrived, and will be installed immediately. The Brush lights at Decatur, Ala., were started up for the first time on the occasion of the banquet of the Associated Press of Alabama, the members of which were greatly pleased with the lights. The electric illumination at Decatur is, we understand, giving very general satisfaction.—*Baltimore Manufacturers' Record.*

APPLICATIONS OF POWER.

Butte, M. T., is to have an electric railway, it is said.

London Tramways.—Operations were begun a few weeks ago with the Ellison storage cars of the North Metropolitan Tram-

way Company's line. On the first day about 1,700 passengers were carried by two cars, and since then one car daily has been running steadily and successfully.

Tacoma, M. T.—A company has been formed to put in an electric railway.

Eureka, Cal.—A company has been formed at Eureka to operate an electric railway.

St. Augustine, Fla.—Northern capitalists are reported to contemplate building an electric railway. They might find a much worse investment.

Cable Roads.—Although cable roads have been in existence so long, the total length in this country in operation or in course of construction does not exceed 150 miles.

The Jarman Tram Car System.—Tests were made recently at Brixton, London, of a Jarman electric car on a line of grade 1 in 40, and with a curve of 43 feet radius. The trial appears to have been successful. Full speed was obtained within a few yards, and the car was stopped within a space of 6 feet, when going 8 miles an hour.

Waiting for Electric Motors.—It is said that a company in London, England, furnishes water at a pressure of 700 lbs. to the square inch for water motors to run elevators, printing presses, pumps, etc. It is reported to have 20 miles of mains and 458 motors in use. It would pay this company to change its system, and substitute electric motors for the others.

Riverside, Cal.—The Riverside & Arlington Electric Railway Company has been organized at Riverside, with a capital stock of $500,000, to build and operate 12½ miles of electric railway. The directors are Mr. Gage, S. C. Evans, J. Bettner, A. S. White, T. Bakewell, G. O. Newman, and Dr. J. J. Jarvis. Work is to be begun as soon as the city franchise has been obtained.

Ontario, Cal.—According to announcement made in our advertising column, tenders are wanted for an electric railway on Euclid avenue, Ontario, Cal. It is to be 8 miles long and to have two trains of two cars each. The system will be run by water-power. California will soon have a large number of electric roads and such a contract as this may be advantageous in helping to introduce a system in the State.

Brooklyn, N. Y.—A reporter of the *Commercial Advertiser* says that the recent break of the cable on the Park avenue line, together with other unforeseen circumstances which have developed in the working of cable roads, have prejudiced some of the directors of the Brooklyn Railway Company in favor of electric motors. Stockholders representing an interest to the value of $3,000,000 are in favor of a change.

Gratiot, Mich.—The Gratiot Electric Railway Company has built a road to connect with the Port Huron Electric Railway. The new road runs to the Windermere Summer Hotel and Huronia Beach on the shore of Lake Huron. The length of track is two miles. 16 lb. T rail being used. The railway stock at present consists of one electric motor car and one summer car; the power is furnished by the Port Huron Electric Railway plant. The Van Depoele overhead system is used. The capital stock of the company is $25,000. The president is W. F. Bottsford; vice-president, John F. Talbot; secretary and superintendent, Jas. H. Talbot; treasurer, C. A. Ward; who are directors with S. L. Ballentine.

PERSONALS.

Mr. Edison's Beefsteak.—Mr. Edison, the famous electrician, eats no meat other than beefsteak. Boys who wish to become great inventors should bear this fact in mind.

Mr. J. H. Walker.—The Fuel Gas and Electric Engineering Company, of Pittsburgh, has secured the services of Mr. Jas. H. Walker as manager of its gas department. Mr. Walker's several years' connection with the Parker-Russell Company, of St. Louis, will cause him to be remembered by the Western members of the gas fraternity.—*Light, Heat and Power.*

Prof. W. A. Anthony.—A special dispatch from Cornell says: "Greatly to the surprise of every one connected with the University, Prof. William A. Anthony, of the Department of Physics and Experimental Mechanics, has tendered his resignation, to take effect immediately. Inquiry as to the cause of his leaving the faculty of Cornell, of which he has so long been a valuable member, elicited the information that he had accepted a position of superintendent of an Eastern electric light plant at a salary of $5,000 per annum. The trustees are casting about in search of a suitable successor to Prof. Anthony, but thus far they have made no selection." It is said that Prof. Anthony joins the Mather Company.

Mr. J. Chester Wilson.—A meeting of the State Board of Building Commissioners for the erection of the Pennsylvania State Industrial Reformatory at Huntingdon was held in Pittsburgh on Thursday. The progress of the work was discussed and it was the opinion that the reformatory should be completed and ready for use early next year—perhaps by Jan. 1, or at least not later than April 1, 1888. They elected J. Chester Wilson, electrical expert, of this city, to supervise the introduction of the electric light, etc. It is expected that 800 incandescent and a large number of arc lights will be necessary to properly illuminate the buildings, contracts for which will be let after Mr. Wilson prepares his report upon the subject and submits it to the commissioners at their next meeting, which will be held July 27. —*Altoona, Pa., Tribune.*

MISCELLANEOUS NOTES.

A New Police System.—The Police Electric Assistance Company, of Jersey City, has been organized by A. Shotwell and others with a capital stock of $300,000.

University of Kansas.—At the beginning of its term next September, the University of Kansas will offer, in addition to its general and special course, a four years' course in electrical engineering.

Fractured by Lightning.—A correspondent of *Fire and Water* writing from New Britain, Conn., says: "During the heavy thunderstorm of Feb. 18, the lightning, in addition to burning out a coil on the fire-alarm circuit, thus disabling the alarm for about an hour, also did considerable damage to the water main on John street. Closely following a heavy flash of lightning, people in the act of drawing water from their faucets heard a cracking sound. One woman, who had her hand on the faucet, received quite an electric shock, and the water ceased running. On investigation, it was discovered that the four-inch cement-lined water main had burst in a number of places. Up to this time there have been found ten different breaks in the main, within a distance of 300 yards. All the breaks are on the top of the pipe, as if it had been struck with a heavy tool of some kind. Such a freak of lightning has never occurred in this city before. The bolt is supposed to have ran down inside of the jacket of a fire-hydrant close to one of the breaks."

BUSINESS NOTICES.

The Harrison Safety Boiler Works, Philadelphia, have furnished a 60 h. p. safety pump to the Haverford, Pa., Electric Light Company; also one of their latest forms of small boilers for a plant in the Provident Light and Trust Company's building, Philadelphia. The latter installation is being made by the Electro-Dynamic Company.

Telegraph Wire.—The Trenton Iron Company, of which our worthy mayor is president, was incorported as far back as 1847. It manufactures all kinds of iron and steel wire, and issues a special circular with regard to its galvanized wire for telegraph and telephone purposes. The wire is furnished in long lengths, and the most careful mechanical and electrical tests are made to insure the quality of each grade. Mayor Hewitt's wire is undoubtedly as good as his civic administration.

Gogebic Lands.—Everybody knows or has read something about the wonderful development of iron mining in the Gogebic district of Michigan and Wisconsin. Many of our readers will be interested to learn that a large block of these lands, about 68,000 acres, is owned by E. P. Allis, the well-known machine builder of Milwaukee, and by H. B. Merrell conjointly. It is the intention of the owners to prospect actively during the present season locate mines and lease them, or to give options to parties who may desire to explore and locate for themselves. Full particulars and information on the subject can be obtained from either of the above gentlemen, or from Mr. E. R. Swain, Bessemer, Mich.

STOCK QUOTATIONS.

The following list, compiled by Mr. W. H. Baker, member New York Stock Exchange, 16 and 18 Broad street, gives the current quotations of electrical stocks:

June 29, 1887.

TELEGRAPH.	Bid.	Asked.
Am. Dist.	.....	37
Am. Tel. & Cable	75½	77
Cen. & So. Am.	96	100
*Com. Tel	.....	.....
*Gold & Stock	.....	.....
*Inter. Ocean Tel.	.....	.....
N. Y. Mutual	78	80
Pac. & Atl.	48	54
*Postal T. & C.	.....	.....
South. & Atl.	68	75
W. U. Tel.	78¼	78⅝
W. U. Scrip	76	.....
W. U. Bonds	119	120
Mut. U. Bonds	85	86
TELEPHONE.		
Am. Bell	218	220
Am. Speaking	110	120
Erie	34	34½
*Hudson River	.....	60

TELEPHONE.	Bid.	Asked.
Mexican	.....	.....
*N. Y. & N. J.	87	92
N. Y. & Pa.	.....	.....
New England	44	45
*Southern Bell	125	135
ELECTRIC LIGHT.		
*Am. Electric	.....	.....
*Brush	.....	.....
*Brush Ill	.....	.....
*Consolidated	.....	.....
*Daft	.....	.....
*Edison	237	240
*Edison Ill	98	100
*Edison Isolated	.....	.....
*United States	.....	.....
*U. S. Ill	.....	.....
MOTOR.		
*Daft	.....	.....
*Sprague	.....	.....

* These stocks are so seldom dealt in that it is difficult to give prices at which they can be bought or sold. The figures given are as near as can be ascertained.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

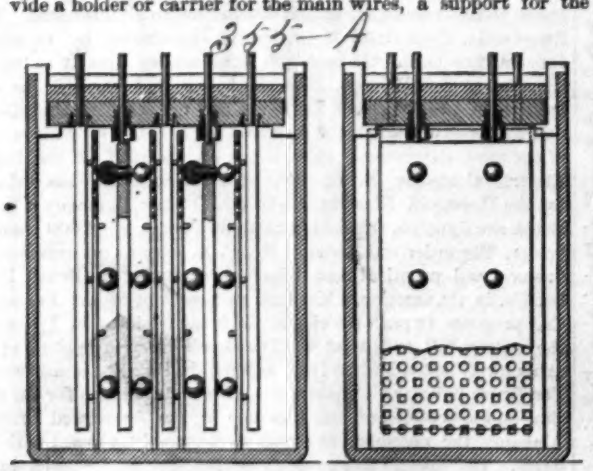
PATENTS DATED JUNE 14, 1887.

364,639. Galvanic Battery; Victor Francken, of Liége, and E. Bender, of Brussels, Belgium, Assignor to the Leclanché Battery Co., of New York, N. Y. Application filed April 7 1887. A carbon electrode is formed by mingling peroxide of manganese, graphite, sulphur and hydrocarbonaceous cement and water. The mixture is heated to drive off volatile oils.

364,656. Battery Solution; W. P. Kookogey, of Brooklyn, N. Y. Application filed June 12, 1886. A novel method of preparing bichromate of potash solution for batteries.

364,660. Battery Cell; A. V. Meserole, of New York, N. Y., Assignor to the River and Rail Electric Light Co., of West Virginia. Application filed Dec. 1, 1886. Cheap and convenient means for supporting the top of the cell are provided. See illustration.

364,721. Cut-Out Block; E. McEvoy, of New York, N. Y. Application filed Aug. 27, 1886. The object is to provide a holder or carrier for the main wires, a support for the



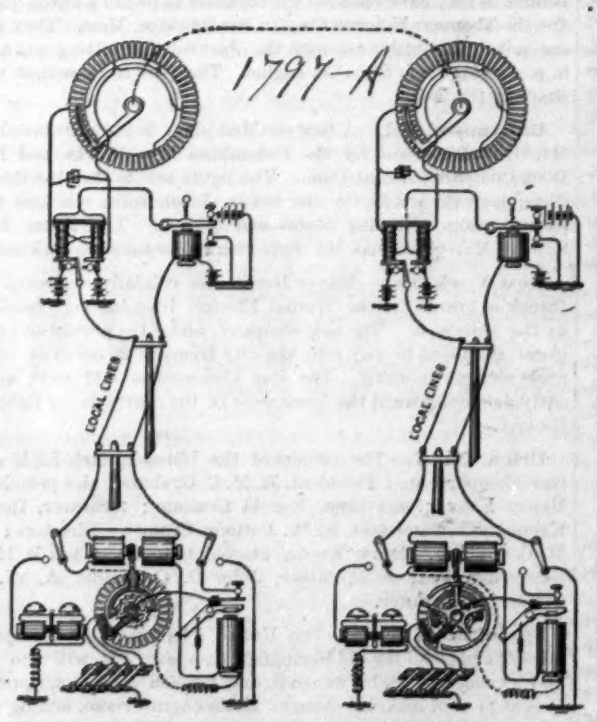
364,660. BATTERY CELL.

tap wires and means for breaking connection when the main wires become overheated.

364,760. Electric Gas-Lighter; C. W. Holtzer, of Brookline, Mass. Application filed Jan. 11, 1887. Improvements in mechanical details and construction.

364,764. Electric Burglar Alarm; G. B. Lehy, of Boston, Mass. Application filed July 20, 1886. Two primary circuits lead from a main battery; each circuit contains two magnets, one located outside and one inside the safe or apartment to be protected. The two circuits operate an alarm.

(1) **364,893**; (2) **364,894. Synchronous Telegraphy**; R. G. Brown, of Brooklyn, As[illegible] to the Standard Multiplex Telegraph Co., of New Y[illegible] N. Y. Applicatinn filed Jan



364,893. SYNCHRONOUS TELEGRAPHY.

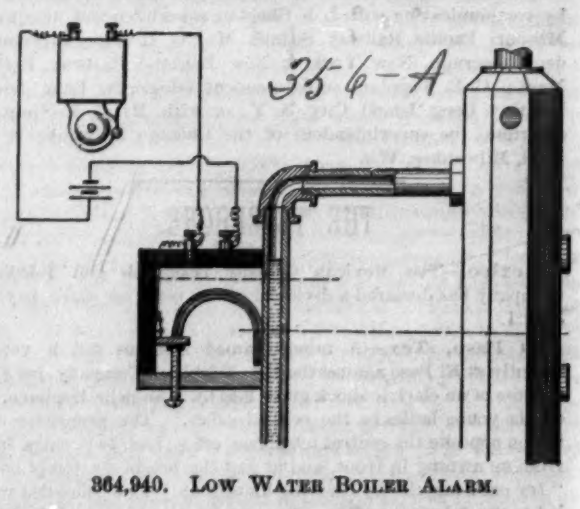
26, 1887. (1) Claim 1.—The combination, with synchronously revolving trailers and the circles of segments, of branch circuit connections from alternate segments, reversing relays, main batteries, and transmitting relay for placing either main battery on the line to be pulsated by the trailers through the two reversing relays. (2) Claim 1.—The combination, with synchronously moving trailers and circles of segments and the line circuit, of printing telegraph instruments, local line wires, reversing batteries, and circuit changing armatures, a reversing relay and branch local circuits to the trailers for actuating the circuit-changing armatures.

364,940. Low Water Alarm for Steam Boilers; W. J. Kassler, of Brooklyn, N. Y. Application filed Nov. 6, 1886. This invention relates to means for utilizing the heat from steam, and an electric current for the purpose of giving notice of the condition of water in steam boilers. See illustration.

364,975. Instrument to Assist Hearing; L. Townley and W. J. Washburn, of St. Louis, Mo. Application filed Dec. 10, 1885. The ear pieces or tips of a speaking tube are connected with the poles of a battery, thus causing a current to pass through the head so as to facilitate hearing.

364,994. Terminal or Distributing Box; F. E. Degenhardt, of Chicago, Ill. Application filed Jan. 8, 1887. The box is provided with binding posts to which the several wires of the cable are run. The main cable passes through a tube into the box. The tube is provided with gripping devices.

365,018. Electrical Device for Operating Elevator Valves; C. Otis, of Brooklyn, N. Y. Application filed Dec.



364,940. LOW WATER BOILER ALARM.

31, 1886. The valve is operated by an electromotor, which is reversible by means of a switch located in the elevator car.

Copies of the specifications and drawings complete of any of the patents mentioned in this record—or of any other patent issued since 1866—can be had from this office for 25 cents. Give the date and number of patent desired, and address Johnston's Patent Agency, Potter Building, New York.